Expanding Use of the AHRQ Prevention Quality Indicators
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Report on the Clinical Expert Review Panel

AHRQ Quality Indicators

Expanding Use of the Prevention Quality Indicators: Report of Clinical Expert Review Panel

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1.0 Introduction

The Prevention Quality Indicators (PQI) are derived from measures created in the late 1990's as indicators of area level outpatient access to quality care. The indicators were subsequently developed into an Agency for Healthcare Quality and Research (AHRQ) Quality Indicator (QI) module, and then endorsed by the National Quality Forum. The AHRQ PQI have been used by state agencies and others to investigate issues of access to care at a regional level. In addition, preventable hospitalizations have been considered by the Centers for Medicare and Medicaid Services (CMS) in the Ninth Scope of Work and by the Organization for Economic Cooperation and Development member states. Interest in these indicators has expanded to include new patient populations and use in comparative reporting and pay-for-performance initiatives. Yet there is little evidence regarding the use of the PQI for these populations and purposes, especially concerning potential need for additional risk-adjustment for comparisons among medical providers. This study aims to explore these additional uses and their implications for the Prevention Quality Indicators.

The Prevention Quality Indicators grew out of work led in the early 1990s by John Billings[1] and Joel Weissman.[2] Numerous studies have shown a correlation between rates of potentially preventable hospitalization indicators (when measured as a set) with area-level income, insurance status and other measures of socioeconomic status.[1,2] Additional studies have found relationships between higher admission rates with self-ratings of poor access to care and higher physician to population ratios.[3-9] While studies continue to show a link between area level access to care and potentially avoidable hospitalization rates in some populations,[10,11] no studies have reassessed the face validity of these indicators since their original inception, despite advances in clinical medicine and changes in practice patterns.

The advances in clinical therapy have multiple implications for the indicators. First, care in some cases has shifted at least in part to outpatient facilities. The safe management of some patients in the outpatient setting may result in only the sickest patients being hospitalized and therefore impact the face validity of using these remaining hospitalizations as quality or access indicators. Second, the practices of managing these conditions have changed. For instance, the management of congestive heart failure has changed dramatically over the past 15 years, with increased awareness of the efficacy of beta-blockers and ACE inhibitors and other pharmaceutical therapy. Again, this may change the face validity of using these indicators.

Recent interest in the PQI has increased and resulted in expanding the potential uses of the PQI; domestic and international users have considered adapting the PQI to assess integrated health care systems, health plans, or international health systems.[12] The PQI are likely to be used in the future for comparative reporting and pay for performance purposes, making validation efforts crucial.

2.0 Methods

In order to investigate the consensual validity of the indicators for these new applications and to re-establish validity for current uses, we convened a clinical panel, using the methods we have previously employed for the Patient Safety Indicators and Inpatient Quality Indicators modules. The development of clinical panel reviews was based on the RAND appropriateness method, a modified Delphi process, also known as the nominal group technique.[13-16] In addition, we implemented a novel, concurrent and interactive Delphi panel review. In conjunction with these panel reviews we conducted a review of the peer review literature to update evidence surrounding the use of these indicators, and conducted empirical analyses to help inform the panel evaluation and investigate alternative definitions.

2.1 Selection of Indicators

All Prevention Quality Indicators were included in this review with the exception of two indicators. We did not include pediatric indicators based on the PQI or low birth weight as these indicators were previously reviewed during the Pediatric Quality Indicators (PDI) panel process. Second, we did not include PQI 14, uncontrolled diabetes, as this indicator is designed to augment the short term diabetes complications indicator in order to bring it in line with Healthy People 2010. In all, 12 indicators were evaluated.

2.2 Literature Review

Literature searches were conducted to update the literature reviews for each PQI from 2004-2008. Search algorithms, similar to the diabetes example given below, were developed to capture pertinent articles. All abstracts were screened for relevance. Articles from the US and developed health care systems, which assessed the impact of interventions on hospitalization rates for the PQI conditions, the validity of administrative data, and issues of bias for condition-based hospitalization rates were abstracted. Narrative summaries were created, which then fed into the panel review process described below. See Appendix A for an example literature summary.

Example search string for diabetes:

("Diabetes Mellitus"[Mesh] NOT "Diabetes, Gestational"[Mesh]) AND ((("Blood Glucose Self-Monitoring"[Mesh] OR "Preventive Health Services"[Mesh]) OR "Office Visits"[Mesh]) OR ("Ambulatory Care"[Mesh] OR "Ambulatory Care Facilities"[Mesh])) AND ("Hospitalization"[Mesh] OR "Emergency Medical Services"[Mesh]) OR ("Diabetes Mellitus"[Mesh] NOT "Diabetes, Gestational"[Mesh]) AND ("Hospitalization"[Mesh] OR "Emergency Medical Services"[Mesh]) AND ("Quality of Health Care"[Mesh] OR "United States Agency for Healthcare Research and Quality"[Mesh] OR "Health Care Quality, Access, and Evaluation"[Mesh]) AND ("2004/7/1"[PDAT] : "2010/01/01"[PDAT])

2.3 Uses Evaluated

Each indicator was evaluated for three potential uses for three potential denominator levels. Long term care was added in the final evaluation as a fourth denominator level. Table 1 lists the evaluated levels and uses. The indicators could be applied to four different data sets: hospitalization data from a geographic area or areas; hospitalization data for enrollees of payor organizations (e.g., health plans); hospitalization data for large provider organizations; and hospitalization for residents of long term care facilities. Once applied, the data could be used in three manners: first, internally within an organization to identify potential problems in order to trigger further investigation and quality improvement initiatives; second, to compare areas or organizations either publicly or privately; and finally, as a measure in a pay for performance program.

For payor and provider levels, the evaluation materials presented to panelists described a denominator which would utilize outpatient administrative data to identify the appropriate population at risk. For example, a payor level PQI would be applicable to only patients at risk for the potential hospitalization (e.g., those with a prior diagnosis of diabetes in the outpatient data for the amputation indicator) and enrolled in the payor program(s) under evaluation. We did not specify risk adjustment in this initial review.

Table 1. Potential Uses and Levels (X denotes combinations evaluated)

	Quality Improvement	Comparative Reporting	Pay for Performance
Area Level		X	
Payor Level		X	X
Provider Group Level	X	X	X
Long-term Care Level[1]	X	X	X

[1] We initially assessed the internal quality improvement application for large provider groups. Following our initial rating period, panelists expressed interest in applying select indicators to the long term care setting and these applications were added to the questionnaire.

2.4 Area Level Uses

The PQI have been defined using a denominator of county or Metropolitan Statistical Area population and a numerator of hospitalizations for a condition within that area. These area level indicators have been used by researchers and public health organizations to identify areas with high levels of potentially preventable hospitalizations, and in turn potential problems with access to high quality outpatient care.

For instance, some state level public health agencies have published maps of potentially preventable hospitalization by county, identifying those with statistically higher rates. These analyses may be used in policy decisions or other interventions to improve access to quality care.

Area level indicators may be adjusted for basic demographics (age, sex), disease prevalence in a few conditions where this information is available, or by socioeconomic status, if the user chooses.

2.5 Payor Level Uses

Payor organizations include state Medicaid agencies and their contracted managed care plans, State Children's Health Insurance Program (SCHIP) agencies and their contracted managed care plans, Medicare Advantage plans, and private managed care plans. Some states have proposed using the PQI as a means of examining the effectiveness of these payor organizations in facilitating access and quality of care. For example, payor organizations may improve access to quality care by negotiating contracts with more physicians willing to accept Medicaid populations, promotion of preventive care, or appropriate approval of clinical services. States may choose to publicly report payor organization performance for the PQI, facilitating consumer choice. Some states are also proposing to adjust contractual agreements with payor organizations based on their performance on a variety of issues, including PQI rates.

Payor level uses may have a denominator specific to the true population at risk, such as only patients diagnosed with specific chronic diseases. They may also be risk adjusted for basic demographics (age, sex), disease burden, or by socioeconomic status, if the user chooses.

2.6 Provider Group Level Uses

Provider organizations include capitated physician organizations and similar entities that provide comprehensive inpatient and outpatient care for a defined population. Some payor organizations have proposed using the PQI as a means of examining the effectiveness of these provider organizations in providing accessible and high quality care. Provider organizations may improve the accessibility of care by improving access to primary care physicians, extending clinic hours or providing urgent care services, and the use of physician substitutes (e.g., nurse practitioners, physician assistants). These organizations may improve quality of care by appropriate patient education, providing preventive care, care coordination, timely and accurate diagnoses and appropriate treatment for acute concerns. Some provider organizations may choose to use the PQI to improve quality in their organizations by identifying conditions which have higher hospitalization rates or subpopulations that have higher hospitalization rates for the PQI. Others have proposed publicly reporting the rates of potentially preventable hospitalizations for large provider organizations, facilitating consumer choice. Some have also proposed providing incentives or adjusting contracts with provider organizations based on their performance on the PQI.

Provider level uses would utilize a denominator specific to the true population at risk, such as only patients diagnosed with specific chronic diseases. They may also be risk adjusted for basic demographics (age, sex), disease burden, or by socioeconomic status, if the user chooses.

As noted in the results section of this review, panelists suggested adding a fourth denominator level, namely long term care settings. The proposed uses for this denominator mirror those of the provider group denominator level.

2.7 Risk Adjustment

The final aspect explored in this panel review, is the importance of various data elements in risk adjustment models. Panelists were asked to rate the importance of including various data elements in a risk adjustment model, using a 4-point scale. Potential data elements included comorbidities, prior hospitalizations, emergency department (ED) visits and pharmaceutical use within the past year, comorbidities, hospital admissions, prior ED visits in the year following intake for patients joining a plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group, socioeconomic status (measured by median income in patient zip code), race, age, gender, need for interpretation services, and consistent vs. changing payor coverage over past 3 years.

2.8 Panel Composition

We conducted a simultaneous and interactive review of the indicators using a hybrid Delphi and Nominal panel approach (described in detail in Solicitation of Nominees section below). In this approach we formed one group, called the Delphi panel, which was comprised of a larger number of panelists and a broader variety of specialists. This panel evaluated indicators using a modified Delphi technique; using a mail-based evaluation process. We also formed a smaller second group, called the Nominal panel. This group participated in conference calls in addition to evaluating the indicators using the same questionnaires as Delphi panelists.

We designed our panels to include physicians, chronic disease specialists and public health personnel. Tables 2 and 3 show the characteristics of the Nominal group and Delphi group.

Table 2. Percentage of Panelist Characteristics by Group

Characteristic	Delphi Group (n = 42)	Nominal Group (n = 23)
Gender		
Male	62.8	73.9
Female	37.2	26.1
Urban/Rural[1]		
Urban	32.6	30.4
Suburban	14.0	13.0
Rural	7.0	8.7
Multiple/All areas served	16.3	30.4
Academic Affiliation[1]		
Academic practice	27.9	47.8
Non-academic practice	34.9	30.4
Any academic affiliation	69.8	87.0
Underserved population served		
in practice[1]	46.5	69.6
Funding[1]		
Public	27.9	34.8
Private and/or Non-profit	20.9	39.1
Multiple sources	7.0	0

[1]This information was not provided by all panelists.

Table 3. Number of Specialties Represented by Panel

Specialty	Delphi Panel	Nominal Panel
Internal Medicine	5	3
Family Medicine	4	1
Geriatric Medicine	2	2
Public Health Physician	4	0
Emergency Medicine	3	2
General Nurse Practitioner	2	1
Endocrinology	4	2
Vascular Surgery	2	1
Diabetes Outpatient Management	1	1
Nephrology	0	1
Cardiology	4	3
Pulmonology	3	2
Asthma Specialist	1	0
Pulmonary Rehabilitation	1	0
Infectious Disease	2	2
General Surgery	3	2
Urology	1	0

Total	42	23

2.9 Solicitation of Nominees

We contacted 24 national clinical organizations to solicit nominations for the clinical panelists, including doctors, nurses, public health and auxiliary health care professions, after compiling a list of organizations based on the desired composition of clinicians for each panel. A list of these organizations can be found in Table 4.

These organizations nominated a total of 174 clinicians. All nominees were invited to participate, if eligible. In order to be eligible to participate, nominees were required to spend at least 30% or more of their work time directly related to patient care or public health programs. They must provide care in an outpatient or emergency department setting and be available to complete any applicable surveys and conference calls during the time period of the panel review. Nominees were asked to provide information regarding their practice characteristics, including specialty, subspecialty, and setting (i.e., urban vs. rural location, region of country, and service to underserved populations), primary hospital of practice (i.e., funding source), and involvement in education (i.e., clinical training, academic affiliation).

Moreover, to ensure appropriate clinical expertise on each panel, we identified the specialties that would be required to properly evaluate the indicators assigned to that panel. Panelists were selected so that each panel had diverse membership in terms of practice characteristics and setting, to the extent possible. Thus, when a specific geographic area or type of clinician (e.g. academic) was over-represented by the pool of eligible nominees, randomly drawn members from that specific sub-group were contacted first to fill the panels. In addition, conference call scheduling logistics influenced assignments.

Of the 104 nominees accepting the invitation, 16 clinicians were ineligible to participate based on these inclusion criteria. Of the remaining 88 nominees, 48 were assigned to the Delphi clinical panels and 25 were assigned to the Nominal panels. The remaining panelists were placed on a waiting list.

Table 4. Organizations Contacted for Nominations of Panelists

American College of Physicians
Society of Hospital Medicine
Society of General Internal Medicine
American Academy of Family Physicians
The American Geriatrics Society
American Public Health Association, Medical Care Section
American College of Emergency Physicians
American Academy of Nurse Practitioners
American Academy of Clinical Endocrinologists
Society for Vascular Surgery
American Association of Diabetes Educators
American Dietetic Association
The American Society of Nephrology
American Academy of Neurology
American College of Cardiology
American Thoracic Society

American College of Chest Physicians
American Association of Cardiovascular and Pulmonary Rehabilitation
American Academy of Allergy Asthma and Immunology
Association for Professionals in Infection Control and Epidemiology
Infectious Disease Association of California
Infectious Diseases Society of America
American College of Surgeons
American Urological Association

We assigned the nominees to one of four groups:

1. *Nominal panel core panelists.* These panelists included general practitioners, such as internists, hospitalists, geriatricians, nurse practitioners, and public health or community health physicians who reviewed all indicators and participated in all conference calls.
2. *Nominal panel specialty panelists.* These panelists included specialists, such as cardiologists, nephrologists, surgeons, infectious disease clinicians, etc., who reviewed only the indicators applicable to their specialty and participated only in the conference calls covering those indicators.
3. *Delphi panel core panelists.* These panelists included general practitioners as in the nominal group core panelists, and reviewed all indicators as indicated in the Delphi group process.
4. *Delphi panel specialty panelists.* Like the nominal counterpart, this group included only specialists who evaluated only those indicators directly applicable to their specialty.

2.10 Panel Process

We utilized a hybrid approach for the panel review, using two review processes, which were conducted simultaneously with information exchange between the two panels. The development of this hybrid process builds from the experiences in previous panel evaluations of QI modules. The panel process that has been employed during the development of the PSIs, the PDIs and the validation of the IQIs is based on the RAND-UCLA Appropriateness Method and is termed a “nominal group” panel.

Nominal Panel

This approach has the advantage of allowing open discussion between panel members, better ability to reach consensus on definitional issues, and an ability to thoroughly explore specific issues and questions with a group of experts. However, the method is limited by the fact that the expert panel must be limited in size in order to facilitate discussion and evaluation of the indicators. Representation of any one specialty is therefore limited to at most a handful of individuals, and one strong opinion may drive the tenor of the discussion and influence the final ratings. Reliability of this process is inherently less robust as compared to other processes because of the small size of the expert panel.

Delphi Method

An alternative approach to establishing face validity is the “Delphi method.” The Delphi method uses a larger group of experts, which independently evaluate indicators utilizing a questionnaire via post. The results are summarized and distributed to the group of experts for a second round of ratings. Additional summaries and rounds can be employed as required. This approach allows a larger number of opinions to

be expressed and explored, and the independent nature of the rating process reduces the impact that any one individual can have on the rating results. However, in this process, information sharing between specialties is hampered by the impersonal rating method, and it is more difficult to explore potential modifications that may improve the indicator ratings. Delphi processes requiring multiple rounds are also very time and resource intensive.

New Hybrid Method

We utilized a hybrid multistep panel rating model that allows one to take advantage of the strengths of both methods, such that both the Nominal panel and the Delphi panel share information with each other in evaluating the indicators. The final Delphi panel consisted of 42 panelists. Eight of the original 48 panelists withdrew; however, 2 seats were filled from the waiting list. This panel was sent a packet of materials, including the indicator definition, background materials on coding guidelines and the AHRQ Quality Indicators, nationwide rates of each PQI as reported in HCUPnet (www.ahrq.gov/data/hcup), and a literature review summarizing literature-based evidence. The panel then utilized that information and their own clinical expertise to complete a 15-item questionnaire. The questionnaire evaluated the face validity of the indicators, the panelists' perspectives on bias and potential for gaming, and the overall usefulness of the indicators when applied at one of three levels of the health care system: area, payor and large provider organizations, for one of three purposes: internal quality improvement, comparative reporting (either public or not), and pay for performance. In addition, the panelists completed a questionnaire on risk adjustment for the indicators. See Appendix B for an example panel packet and questionnaires. The results from the questionnaire were compiled and redistributed to the Delphi panel for comments. One panelist submitted additional comments.

The final Nominal Panel consisted of 23 panelists. Three of the original 25 panelists withdrew, but 1 seat was filled from the waitlist. This panel was sent the same packet as the Delphi panel, and asked to complete the questionnaire. The results from this panel were compiled and distributed back to the Nominal panel along with the compiled results and comments from the Delphi panel. Those in the Nominal panel then participated in at least one of three conference calls. The agenda for these calls was set based on the first round of review from both the Nominal panel and the Delphi panel. Each conference call was two hours long and covered 3-5 indicators, as below. The purpose of the calls was to share information and opinions, and not to reach consensus regarding the indicators. When changes to indicator numerators were discussed, we surveyed all call participants to ensure general agreement regarding that change.

Call 1, Diabetes:

- Diabetes, short-term complications (PQI 1)
- Diabetes, long-term complications (PQI 3)
- Lower extremity amputations among patients with diabetes (PQI 16)

Call 2, Other chronic conditions:

- Chronic obstructive pulmonary disease (PQI 5)
- Hypertension (PQI 7)
- Congestive heart failure (PQI 8)
- Angina without procedure (PQI 13)

- Adult asthma (PQI 15)

Call 3, Acute conditions:

- Perforated appendix (PQI 2)
- Dehydration (PQI 10)
- Bacterial pneumonia (PQI 11)
- Urinary infections (PQI 12)

Following the call, we conducted empirical analyses to explore potential indicator modifications as well as analyses to return information to panelists regarding issues they raised during the conference call. Analyses were conducted using the Nationwide Inpatient Sample, 2004-2005. Examples of analyses included evaluating the impact of proposed modifications to the numerator population, examining the breakdown of numerator codes, or the numerator share attributable to specific clinical groups. Because only inpatient data were available, only suggested changes to the numerator were evaluated.

2.11 Data analyses

For the purpose of analyzing the data, the Delphi Group and the Nominal Group were first considered separately. For each group we calculated the mean, median and standard deviation for each question. We then assigned a level of within-panel agreement for each question as follows:

1. With agreement: less than 15% of responses fall outside the 3 point range containing the median (1-3, 4-6, or 7-9),
2. With disagreement: at least 20% of responses fall inside the two extreme 3 point ranges (1-3, 7-9), or
3. With indeterminate agreement: response distribution does not qualify as "with agreement" or "with disagreement"

Being that the purpose of the panel process for this project is to inform different uses, and not to select indicators, the summary categories reflect levels of "support" or "concern." For the overall usefulness questions we identified the following summary categories:

1. Full support for use: Median score of 7-9 without disagreement
2. Some concern regarding use: Median score of 4-6.9 regardless of agreement status
3. General support with some concerns regarding use due to disagreement: Median score of 7-9 with disagreement
4. Major concern regarding use: Median score or 1-3.9 regardless of agreement status

We summarized the results of the two panel groups for between-panel concordances. Support ratings (as described in the summary categories above) between the two groups were compared. When one group rated the indicator in category 4, "Major concern regarding use" and the other group rated the indicator in category 1 or 2, "Full support for use" or "Some concern regarding use" the groups were said not to have reached concordance. Levels of within-panel agreement, support, and between-panel concordance can be found in tables 5-28 below in the Results by Indicator section.

The qualitative comments put forward by each panel were compiled and assigned to 3 general categories: direct support for the utility of the indicator, direct concern for the utility of the indicator, and general comments on issues related to the indicator without direct support or concern. These comments were then summarized. Major arguments both in support and of concern as evidenced by recurring themes from panelist commentary are highlighted below in the Results by Indicator section.

3.0 Results

The results are summarized in three ways. First, results are summarized by each indicator. Panel ratings are presented followed by a summary of qualitative comments about each indicator. Second, results are discussed in the context of specific use: quality improvement, comparative reporting, and pay for performance. Third, we summarize lessons learned by denominator level: area, payor and provider group.

3.1 Results by Indicator

Overall, panelists rated most indicators as useful for at least one application and denominator level; they rated three indicators as less useful. Specifically, perforated appendix received low ratings for all applications and denominator levels. Dehydration received low ratings for all but two applications and denominator levels. Angina also received low ratings for half of the applications and denominator levels. The specific concerns contributing to these ratings are discussed below.

The most salient theme expressed was the need for careful specification of each indicator. While many of the concerns and supporting comments expressed during the panel review spanned many or all indicators, some were indicator specific and affect the specification or implementation of those indicators. The results below show all ratings for each indicator. The overall usefulness ratings for each application and denominator level are of particular importance. Other ratings help to describe the strengths and weaknesses of each indicator. In addition to the ratings, we summarize recurring themes specific to each indicator.

Diabetes Short-term Complications Admission Rate (PQI 1)

Table 5. Diabetes Short-term Complications Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Indeterminate	6	Disagreement
Overall rating – Payor: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: P4P	5	Indeterminate	5	Indeterminate
Overall rating – PO: internal QI	7	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – PO: P4P	6	Indeterminate	5	Indeterminate
Reflects poor access	7	Indeterminate	7	Indeterminate
Reflects poor quality	6	Indeterminate	7	Indeterminate

Charting accuracy	7	Indeterminate	7	Indeterminate
Bias	6	Indeterminate	6	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 6. Diabetes Short-term Complications Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Full support for use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Diabetes Short-term Complications Indicator

- Panelists cited several factors related to access to quality outpatient care that could impact hospitalization rates for these complications, including availability/affordability of medications, insulin and other medical supplies (glucose monitoring), availability of physicians (or appointments), and access to comprehensive diabetes education or care coordination
- Patient factors may limit the impact of the healthcare system on admission rates such as the ability to self-manage insulin levels and diet. Panelists also cited issues such as cultural beliefs or traditions that may impact diet or medication compliance.
- Currently, both type 1 and type 2 diabetes ICD-9-CM codes are included in the definition of the diabetes short-term complications indicator. Arguments in favor of separating type 1 and type 2 patients in the denominator included: a) differing etiology and complications between the conditions, and b) prevention goals with type 2 may be more attainable. Arguments against separating the conditions in the denominator included: a) quality care outcomes may not differ between the conditions, and b) ICD-9-CM codes used in these measures are not always reflective of the true clinical condition as patients may be mistakenly assigned codes from either type 1 or type 2. This variation in coding may be related to factors such as age (type 1 patients receiving type 2 codes when they reach adulthood), insulin prescription or type of procedure the patient receives. Panelists endorsed including both type 1 and type 2 diabetes together.
- To reduce false positives for patients identified as having diabetes, panelists suggested requiring multiple diagnoses in separate encounters over a specified timeframe such as 18-36 months. Panelists felt that patients without diabetes may receive diabetes-related codes mistakenly.
- The presence of observation units may affect hospitalization rates for acute diabetes complications as patients may be cared for in alternative settings.
- Panelists noted that current practice in some emergency departments is to efficiently admit and stabilize the patient and thus may have higher rates than those that are less efficient and hold patients in the emergency department.

- Panelists noted that this indicator may especially expose geographic areas that may benefit from increased targeting of resources. At the area level, panelists also recommended collecting relevant information such as rural/urban status and education level in addition to covariates mentioned above with this indicator when available. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Payor organizations in particular may be able to enhance coverage for medication, supplies for blood glucose monitoring, and care coordination efforts related to diabetes. Payor organizations may also encourage an ongoing approach to patient education for self-management. Careful attention should be paid to risk covariates and adjustment in payor organization uses.
- Provider organizations in particular may be able to enhance care coordination efforts for diabetes patients. However, the sustainability of these programs without increased funding is questionable. Careful attention should be paid to risk covariates and adjustment in provider organization uses.

Perforated Appendix Admission Rate (PQI 2)

Table 7. Perforated Appendix Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	5	Disagreement	3	Indeterminate
Overall rating – Payor: public reporting	5	Disagreement	3	Disagreement
Overall rating – Payor: P4P	3.5	Disagreement	2.5	Disagreement
Overall rating – PO: internal QI	4	Disagreement	3	Disagreement
Overall rating – PO: public reporting	4	Indeterminate	3.5	Disagreement
Overall rating – PO: P4P	4	Indeterminate	2	Disagreement
Reflects poor access	7	Indeterminate	5.5	Disagreement
Reflects poor quality	4	Indeterminate	3	Disagreement
Charting accuracy	8	Agreement	8	Agreement
Bias	3	Indeterminate	4.5	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 8. Perforated Appendix Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Major concern regarding use	No
Payor	Public Reporting	Some concern regarding use	Major concern regarding use	No
	Pay-for-Performance	Major concern regarding use	Major concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Major concern regarding use	No
	Public Reporting	Some concern regarding use	Major concern regarding use	No
	Pay-for-Performance	Some concern regarding use	Major concern regarding use	No

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Perforated Appendix Indicator

- The Perforated Appendix indicator received low ratings across all possible applications. Panelists expressed general concern that the indicator did not necessarily reflect issues of access or quality of care.
- Panelists felt that most appendicitis patients present directly to the emergency room, by-passing the outpatient setting. The timing of that presentation may be the most important factors related to perforation risk. Most panelists felt that time to presentation is largely outside of the health systems control and may vary systematically, while some felt that patient education for appendicitis is not emphasized.
- Age may be of particular concern for this indicator, as the elderly tend to present with atypical symptoms and are therefore difficult to assess.
- Panelists noted that this indicator may especially expose geographic areas that may benefit from increased targeting of resources. At the area level, panelists also recommended collecting relevant information such as rural/urban status and education level in addition to covariates mentioned above with this indicator when available. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Panelists commented that in order for this indicator to accurately reflect access to true quality of care, additional information would be required such as time from onset of symptoms to presentation, from presentation to diagnosis, and from diagnosis to the operating room.
- The use of CT scans may enhance timely diagnosis, but also increases radiation exposure. This risk may be elevated in those who receive repeated scans and in younger age groups.
- When discussing this indicator in particular, the panels distinguished access to care from quality of care. They argued that this indicator is most appropriate to examine *access* (insurance status, geographic limitations, socio-economic/-cultural issues in presentation).
- Negative appendectomy rates may be currently monitored in quality improvement programs within some organizations. This indicator and negative appendectomy rates may be complimentary in measurement efforts.
- Panelists recommended that strong attention be paid to risk covariates and adjustment, particularly age. Other potential risk factors raised for this indicator included rate of patients with diabetes, major tranquilizer use, language barriers, and patients reporting symptoms longer than 24 hours prior to presenting to care, if these data were available.

Diabetes Long-term Complications Admission Rate (PQI 3)

Table 9. Diabetes Long-Term Complications Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	Agreement Status	Median	Agreement Status
Overall rating – Area: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: public reporting	5	Indeterminate	6	Indeterminate
Overall rating – Payor: P4P	5	Indeterminate	4	Indeterminate
Overall rating – PO: internal QI	6	Indeterminate	7	Indeterminate

Overall rating – PO: public reporting	6	Disagreement	6	Indeterminate
Overall rating – PO: P4P	5	Indeterminate	4	Disagreement
Reflects poor access	7	Indeterminate	8	Agreement
Reflects poor quality	6	Indeterminate	7	Indeterminate
Charting accuracy	5	Indeterminate	6	Disagreement
Bias	6	Indeterminate	6	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 10. Diabetes Long-Term Complications Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Full support for use	Yes
Payor	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Diabetes Long-term Complications Indicator

- Panelists cited several factors related to access to quality outpatient care that could impact hospitalization rates for these complications, including availability/affordability of medications, insulin and other medical supplies (glucose monitoring), availability of physicians (or appointments), and access to comprehensive diabetes education or care coordination. With regard to long-term complications in diabetes, these issues may be compounded over an extended period of time.
- Panelists were unsure that tight glucose control would be result in reduced admissions for this indicator.
- Self-management behaviors and lifestyle factors, such as diet, may particularly affect long-term complications of diabetes. Other patient factors may include age, length of time with diabetes, comorbidities, geographic limitations (including ambulation and transportation issues), and cultural differences or beliefs. With regard to long-term complications in diabetes, these issues may be compounded over an extended period of time.
- As these complications develop as a result of poor diabetes control over time, admissions may not clearly be attributable to care practices associated with the payor or provider organization. See section 3.5, Lessons Learned for Adapting the PQI, for more information.
- Currently, both type 1 and type 2 diabetes ICD-9-CM codes are included in the definition of the diabetes short-term complications indicator. Arguments in favor of separating type 1 and type 2 patients in the denominator included: a) differing etiology and complications between the conditions, and b) prevention goals with type 2 may be more attainable. Arguments against separating the conditions in the denominator included: a) quality care outcomes may not differ between the conditions, and b) ICD-9-CM codes used in these measures are not always reflective of the true

clinical condition as patients may be mistakenly assigned codes from either type 1 or type 2. This variation in coding may be related to factors such as age (type 1 patients receiving type 2 codes when they reach adulthood), insulin prescription, or type of procedure the patient receives. Panelists endorsed including both type 1 and type 2 diabetes together.

- Panelists discussed whether to include the ICD-9-CM codes 250.8x (Diabetes with Other Specified Manifestations) and 250.9x (Diabetes with Unspecified Complication). Since the code 250.8x includes hypoglycemia as well as a variety of both acute and chronic complications, we asked panelists to consider the appropriateness of including this group of complications in the Diabetes Long-term Complications indicator. Although not unanimous, many panelists voted that neither ICD-9-CM code (250.8x nor 250.9x) should be included in the numerator definition. The argument against their continued placement in the numerator included a high level of variability in the utilization and particular use of these codes (hypoglycemia vs. diabetic bone changes) and possibly variability due to changes in billing efforts at the system level. A couple of panelists felt that users of this indicator may still benefit from including these codes as they may be heavily used, and therefore, may still have utility in identifying potentially preventable admissions.
- To reduce false positives for patients identified as having diabetes, panelists suggested requiring multiple diagnoses in separate encounters over a specified timeframe such as 18-36 months. Panelists felt that patients without diabetes may receive diabetes-related codes mistakenly.
- Panelists noted that this indicator may especially expose geographic areas that may benefit from increased targeting of resources. At the area level, panelists also recommended collecting relevant information such as rural/urban status and education level in addition to covariates mentioned above with this indicator when available. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Payor organizations in particular may be able enhance coverage for medication, supplies for blood glucose monitoring, and coordinated care efforts related to diabetes. Payor organizations may also encourage an ongoing approach to patient education for self-management. Careful attention should be paid to risk covariates and adjustment in payor organization uses. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Provider organizations in particular may be able to enhance coordinated care efforts for diabetes patients. However, the sustainability of these programs without increased funding is questionable. Careful attention should be paid to risk covariates and adjustment in provider organization uses. See section 3.5 Lessons Learned for Adapting the PQI for more information.

Chronic Obstructive Pulmonary Disease (COPD) Admission Rate (PQI 5)

Table 11. COPD Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Indeterminate	6	Disagreement
Overall rating – Payor: public reporting	6	Disagreement	6	Indeterminate
Overall rating – Payor: P4P	5	Disagreement	5	Indeterminate
Overall rating – PO: internal QI	6	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	6	Disagreement	7	Indeterminate
Overall rating – PO: P4P	5.5	Disagreement	7	Indeterminate

Reflects poor access	6.5	Indeterminate	6	Indeterminate
Reflects poor quality	6	Indeterminate	7	Indeterminate
Charting accuracy	7	Indeterminate	7	Indeterminate
Bias	6	Indeterminate	6	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 12. COPD Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Full support for use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the COPD Indicator

- Panelists advocated for restricting the indicator to patients 40 years of age and older and combining with asthma admissions in this age group. Empirical analysis confirmed that COPD diagnoses in cases under 40 years of age are rare. Panelists felt that combining these groups would eliminate the diagnostic uncertainly between asthma and COPD in older patients, and thus provide a cleaner measure.
- Smoking continuation/cessation may be a key component to disease progression in individuals with COPD. Panelists expressed mixed opinions on the ability of the healthcare system to affect smoking rates. Some noted that payor organizations may enhance coverage beyond current reimbursements available for smoking cessation efforts.
- As with all chronic conditions, comorbidities and disease severity are of concern. For COPD, other respiratory and cardiovascular conditions are of particular concern. Along with risk factors such as age, gender, race/ethnicity, socioeconomic status, and smoking rates, panelists emphasized that environmental factors may affect admissions rates for this indicator. These environmental factors include pollution levels, altitude, climate, and occupational exposures from local industries.
- Panelists also generally agreed that the high cost and complicated protocols for inhaler medications present major barriers to patient adherence to treatment recommendations. They further agreed that it is within the ability of the healthcare system to mitigate these barriers through efforts including offering high quality education on medication needs and inhaler use.
- Panelists felt this indicator may also reflect some amount of "social" hospital admissions. In other words, cases in which the physician determines social support or the home environment are insufficient for recovery outside of the hospital. See section 3.5 Lessons Learned for Adapting the PQI for more on considerations surrounding "social" admissions.
- The presence of observation units may impact admission rates for COPD.

- Payors may impact rates by increasing reimbursement for smoking cessation programs, medications, and ensuring access to pulmonary rehabilitation and oxygen therapy. Further incentives for patient education regarding the use of inhalers and medications, and incentives for enhanced care coordination may assist in preventing hospitalizations.
- Panelists expressed concern for the possibility of adverse selection of more complex patients by organizations subject to this indicator. Careful attention should be paid to risk covariates and adjustment in payor organization uses of this indicator.
- There was slightly more support for implementing the COPD indicator at the provider group denominator level. With consideration of patient factors that may be outside of a provider's control, many panelists endorsed the quality improvement use of this indicator, specifically in improving adherence to guidelines. Careful attention should be paid to risk covariates and adjustment in provider organization uses of this indicator.

Hypertension Admission Rate (PQI 7)

Table 13. Hypertension Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Disagreement	7	Indeterminate
Overall rating – Payor: public reporting	5	Disagreement	7	Indeterminate
Overall rating – Payor: P4P	5	Indeterminate	7	Disagreement
Overall rating – PO: internal QI	5	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	4	Disagreement	6	Disagreement
Overall rating – PO: P4P	4	Disagreement	5.5	Disagreement
Reflects poor access	7	Indeterminate	7	Indeterminate
Reflects poor quality	5	Indeterminate	6	Indeterminate
Charting accuracy	7	Indeterminate	7	Indeterminate
Bias	6	Disagreement	5	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 14. Hypertension Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Full support for use	Yes
Payor	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	General support with concerns	Yes
Provider Organization	Internal QI	Some concern regarding use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Hypertension Indicator

- Hypertension in and of itself is related to a number of other conditions. Panelists made arguments both for and against including admissions with a principal diagnosis for related conditions and a secondary diagnosis of hypertension. Hypertension may not always be included as a secondary diagnosis for these conditions, and panelists expressed that it was difficult to know where to 'draw the line' for conditions that should also be included. Conditions raised included stroke, heart failure, and encephalopathy. A principal diagnosis of hypertension may be a rare event.
- Panelists noted that while for payor and provider applications patients with previously diagnosed hypertension is the most fertile group for intervention, screening remains important and may impact admission rates. For public health applications in particular panelists felt that including all patients in the denominator, regardless of a prior diagnosis of hypertension, would be most appropriate.
- Lack of adherence to medication therapy, sometimes due to affordability concerns, may lead to undesirable patient outcomes. With appropriate use of medications, the panel generally supported the notion that hypertension itself should be managed effectively through the outpatient setting.
- As with all chronic conditions, age, comorbidities and disease severity are of concern. Particular attention may need to be paid to patients with diabetes and cardiovascular conditions. Due to the importance of medications in the management of chronic hypertension, lower socioeconomic status may be an important corollary to the affordability and sustained access to prescriptions in some patient groups. Patient factors beyond the control of the healthcare system that may also affect admission rates for this indicator include smoking, proper diet, and regular exercise.
- This indicator may have increased utility in targeting increased blood pressure screening and prevention of conditions related to hypertension (e.g., stroke, heart failure). Conclusions regarding admission rates for this indicator at the area level should be considered with strict attention to risk variables noted above.
- The payor organization may be able to affect hypertension admission rates through enhanced coverage of preventive primary care visits, ongoing patient education and coverage of anti-hypertensive medications. Applied at the payor organization denominator level, thoughtful consideration of risk covariates and adjustment is needed.
- Provider organizations may be positioned to impact care practices, and ultimately admission rates for this indicator, through regular blood pressure screening and adherence to practice guidelines. Provider groups may also impact care through increased patient education efforts; however, panelists noted that ongoing education may require more funding than currently provided for such programs. Applied at the provider organization denominator level, thoughtful consideration of risk covariates and adjustment is needed.

Congestive Heart Failure (CHF) Admission Rate (PQI 8)

Table 15. CHF Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: public reporting	6	Indeterminate	7	Indeterminate

Overall rating – Payor: P4P	6	Indeterminate	5	Disagreement
Overall rating – PO: internal QI	7	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	7	Indeterminate	7	Indeterminate
Overall rating – PO: P4P	6	Indeterminate	6	Indeterminate
Reflects poor access	7	Indeterminate	7	Indeterminate
Reflects poor quality	7	Indeterminate	7	Indeterminate
Charting accuracy	7	Indeterminate	7	Indeterminate
Bias	6	Indeterminate	4.5	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 16. CHF Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Full support for use	Yes
Payor	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Full support for use	Full support for use	Yes
	Public Reporting	Full support for use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the CHF Indicator

- Panelists cited access to primary care, patient education and a close relationship with the patient for follow-up as important factors in the hospitalization rate for CHF. Access to cardiologists and affordable medications may further ameliorate preventable hospitalizations.
- Panelists noted that adherence to practice guidelines, continuity of care and care coordination constitute cornerstones of high quality care for CHF patients.
- As with all chronic conditions, comorbidities and disease severity are of concern. Particular attention may need to be paid to patients with COPD/Asthma and other cardiovascular conditions. Patient level factors that contribute to hospitalization risk may include urban/rural status, socioeconomic status, adherence to medication and treatment regimen, and lifestyle behaviors (smoking, diet, exercise).
- Hospitalizations may also be coded as dyspnea, hypoxia or to renal deficiency codes (without a note of CHF).
- The presence of observation units and the rate of cardiac procedures may contribute to the variation observed across areas or organizations.
- Panelists generally felt confident that the current state of evidence suggests that adherence to practice guidelines may impact admission rates for this indicator at the geographic area level. But they also noted that careful consideration of risk covariates is still crucial.

- Payor organizations may impact admission rates through enhanced coverage of medications, patient education, regular primary care visits, and outreach to at-risk patients. Applied at the payor organization denominator level, thoughtful consideration of risk covariates and adjustment is needed for proper interpretation and use of admission rates for this indicator.
- The panels showed strong support for implementing the CHF indicator in provider organizations for the purposes of internal quality improvement and comparative reporting. Again, provider organizations may be well positioned to promote adherence to practice guidelines in this patient population. Providers may also concentrate on increasing access to care through teleconferencing, home visits, and ongoing patient education. It should be noted that these interventions may not be financially sustainable without increased funding. Applied at the provider organization denominator level, thoughtful consideration of risk covariates and adjustment is needed for proper interpretation and use of admission rates for this indicator.

Dehydration Admission Rate (PQI 10)

Table 17. Dehydration Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	5	Indeterminate	5	Indeterminate
Overall rating – Payor: public reporting	4	Indeterminate	3	Disagreement
Overall rating – Payor: P4P	4	Indeterminate	3	Disagreement
Overall rating – PO: internal QI	5	Indeterminate	3	Disagreement
Overall rating – PO: public reporting	3	Indeterminate	3	Disagreement
Overall rating – PO: P4P	3	Indeterminate	3	Disagreement
Overall rating – LTCF: internal QI	7	Indeterminate	7	Indeterminate
Overall rating – LTCF: public reporting	7	Indeterminate	7	Indeterminate
Overall rating – LTCF: P4P	7	Indeterminate	8	Indeterminate
Reflects poor access	6	Indeterminate	6	Disagreement
Reflects poor quality	4	Indeterminate	4	Indeterminate
Charting accuracy	7	Indeterminate	7	Indeterminate
Bias	5	Indeterminate	5	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement, LTCF = long-term care facility
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 18. Dehydration Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Major concern regarding use	No
	Pay-for-Performance	Some concern regarding use	Major concern regarding use	No

Provider Organization	Internal QI	Some concern regarding use	Major concern regarding use	No
	Public Reporting	Major concern regarding use	Major concern regarding use	Yes
	Pay-for-Performance	Major concern regarding use	Major concern regarding use	Yes
Long-term care facility	Internal QI	Full support for use	Full support for use	Yes
	Public Reporting	Full support for use	Full support for use	Yes
	Pay-for-Performance	Full support for use	Full support for use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Dehydration Indicator

- The panel discussed including cases with a principal diagnosis of gastroenteritis, hyper- or hyponatremia, azotemia, acute renal failure, respiratory infection, or urinary tract infection when accompanied by a secondary diagnosis of dehydration. Ultimately, the panel supported including two of these co-morbid conditions in the numerator: 1) principal gastroenteritis admissions with dehydration that is present on admission, and 2) principal acute renal failure admission with dehydration that is present on admission. Panelists emphasized that included cases of acute renal failure should not be those with a history of chronic renal failure.
- Patients may not present in a timely manner to prevent admission for dehydration.
- Patients are rarely sent home from ambulatory care with hypovolemia. Differences in practice patterns for managing marginally dehydrated patients may impact the admission rates for this condition, including re-hydration in outpatient settings or use of observation units.
- The elderly may be more likely to be captured in measurements of dehydration. A plethora of comorbidities that may be related to risk for dehydration were mentioned by the panel. For the purposes of assessing risk covariates and adjustment, chronic comorbidities, urban/rural status, and socioeconomic status may be considered along with age.
- Panelists felt this indicator may also reflect some amount of "social" hospital admissions. In other words, cases in which the physician determines social support or the home environment are insufficient for recovery outside of the hospital. See section 3.5 Lessons Learned for Adapting the PQI for more on considerations surrounding "social" admissions.
- There was strong support for dehydration monitoring and quality improvement in long-term care facilities.
- This indicator in particular may aid in exposing geographic areas with decreased access that may benefit from increased targeting of resources. Alternatively, some suggested that with the inclusion of gastroenteritis as a principal diagnosis, this indicator may serve a disease surveillance function in the public health setting. Panelists were not confident in the current state of evidence linking access to quality care and hospitalizations for dehydration at the area level.
- Panelists did not express much confidence in the state of evidence directly linking payor or provider organization interventions to the reduction of admissions for this indicator, but panelists agreed that targeting resources for at-risk patient populations in these organizations would be beneficial.
- Panelists expressed robust support for all long-term care facility uses of the Dehydration indicator. They noted that the Dehydration indicator may be particularly useful for measuring access to quality care in long term care settings, where healthcare providers have greater control over factors such as the availability and intake of fluids and monitoring of medical comorbidities.

Bacterial Pneumonia Admission Rate (PQI 11)

Table 19. Bacterial Pneumonia Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Indeterminate	5	Indeterminate
Overall rating – Payor: public reporting	5	Indeterminate	5.5	Disagreement
Overall rating – Payor: P4P	5	Disagreement	5	Disagreement
Overall rating – PO: internal QI	6	Disagreement	6	Disagreement
Overall rating – PO: public reporting	5	Indeterminate	6	Disagreement
Overall rating – PO: P4P	4.5	Indeterminate	5	Disagreement
Overall rating – LTCF: internal QI	6	Disagreement	7	Indeterminate
Overall rating – LTCF: public reporting	5	Indeterminate	7	Indeterminate
Overall rating – LTCF: P4P	5	Disagreement	6	Disagreement
Reflects poor access	5	Indeterminate	7.5	Agreement
Reflects poor quality	5	Indeterminate	4	Indeterminate
Charting accuracy	7	Indeterminate	8	Indeterminate
Bias	6.5	Indeterminate	5	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement, LTCF = long-term care facility
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 20. Bacterial Pneumonia Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Some concern regarding use	Yes
	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Long-term care facility	Internal QI	Some concern regarding use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Bacterial Pneumonia Indicator

- Panelists suggested that the inclusion of ICD-9-CM code for aspiration pneumonia may be warranted as up to 15% of pneumonia cases may be coded as such; however, these aspiration-associated conditions often require a different processes for prevention and treatment than the conditions originally included in the indicator.
- Panelists cited access to vaccinations as a crucial aspect of preventing pneumonia and subsequent hospitalization.
- Panelists felt that this indicator reflects access to care more than quality of care.
- Patient factors may limit the control the healthcare system has over admission rates. These factors include comorbidities, socioeconomic status, geographic limitations (transportation issues), propensity to present in a timely manner, and cultural differences or beliefs.
- Comorbidities (COPD/Asthma, diabetes, HIV) and patient self-care (smoking) need careful consideration as risk covariates
- Use and affordability of antibiotics may be enhanced with coverage from payor organizations; however, panelists also expressed concern for antibiotic overuse and the emergence of antibiotic-resistant strains in some populations (e.g. long-term care).
- The panelists felt this indicator may also reflect some amount of "social" hospital admissions. In other words, cases in which the physician determines social support or the home environment are insufficient for recovery outside of the hospital. See section 3.5 Lessons Learned for Adapting the PQI for more on considerations surrounding "social" admissions.
- This indicator may aid in exposing geographic areas that may benefit from increased targeting of resources such as vaccinations.
- Payor organizations may assist in preventing hospitalizations by ensuring access to immunizations and antibiotics. Panelists expressed uncertainty about the magnitude of the impact increasing such access would have on hospitalizations for bacterial pneumonia. Careful attention should be paid to risk covariates and adjustment in payor organization uses.
- There may exist substantial variation in admitting thresholds and allocation to various treatment settings across provider organizations. Provider groups may have the ability to promote vaccination in the patient populations. Careful attention should be paid to risk covariates and adjustment in provider organization uses.
- The Bacterial Pneumonia indicator may be pertinent in long-term care, and may be especially pertinent as it relates to the prevention of aspiration pneumonia. Panelists felt that preventing aspiration should be a current quality goal of long-term care facilities through appropriate utilization of feeding tubes and their positioning.

Urinary Tract Infection (UTI) Admission Rate (PQI 12)

Table 21. UTI Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	5	Disagreement	6	Disagreement
Overall rating – Payor: public reporting	4	Disagreement	5	Disagreement
Overall rating – Payor: P4P	4	Indeterminate	3	Disagreement
Overall rating – PO: internal QI	5	Disagreement	6	Disagreement
Overall rating – PO: public reporting	4	Indeterminate	4	Disagreement

Overall rating – PO: P4P	4	Indeterminate	3	Disagreement
Overall rating – LTCF: internal QI	7	Disagreement	8	Indeterminate
Overall rating – LTCF: public reporting	7	Disagreement	7	Indeterminate
Overall rating – LTCF: P4P	5	Disagreement	7	Indeterminate
Reflects poor access	5.5	Indeterminate	7	Indeterminate
Reflects poor quality	4.5	Indeterminate	6	Disagreement
Charting accuracy	7	Indeterminate	8	Agreement
Bias	4.5	Indeterminate	3	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement, LTCF = long-term care facility
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 22. UTI Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Major concern regarding use	No
Provider Organization	Internal QI	Some concern regarding use	Some concern regarding use	Yes
	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Major concern regarding use	No
Long-term care facility	Internal QI	General support with concerns	Full support for use	Yes
	Public Reporting	General support with concerns	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Full support for use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Urinary Tract Infection Indicator

- The panels favored inclusion of sepsis as a primary diagnosis with UTI as a secondary diagnosis in the numerator definition, but it will be important to complete further validation following this change. Admission purely related to primary diagnosis for UTI may be rare.
- Many panelists felt that UTI should be effectively treated on an outpatient basis given timely presentation; thus access to care is of utmost importance. The availability of telephone consults may improve care for UTI . The panelists generally felt that the cases that develop into serious infection prior to admission tended to present directly to the emergency department.
- The elderly are particularly likely to present with atypical symptoms, making diagnosis difficult in this patient population.
- Comorbidities such as diabetes, dehydration, and mental illness may also impact hospitalization rates and, along with age, should be considered for risk adjustment. It may also be of value to examine

rates of these factors when interpreting this indicator using rates of UTI as a secondary diagnosis in these comorbidities.

- Panelists felt this indicator may also reflect some amount of "social" hospital admissions. In other words, cases in which the physician determines social support or the home environment are insufficient for recovery outside of the hospital. See section 3.5 Lessons Learned for Adapting the PQI for more on considerations surrounding "social" admissions.
- This indicator may aid in exposing geographic areas that have decreased access and may benefit from increased targeting of resources. Panelists also raised the possibility of using this indicator as a surrogate measure for prevalence of antibiotic-resistant strains.
- Payors may enhance coverage of antibiotics to improve affordability and access to antibiotics; however, panelists expressed concern regarding antibiotic overuse and the emergence of antibiotic-resistant strains in some populations (e.g. long-term care).
- Although panelists did not express much confidence in the evidence directly linking payor or provider organization interventions to reduced admissions for this indicator, members of the nominal panel agreed that targeting resources in these poorly performing organizations remains important.
- Inappropriate use of Foley/suprapubic catheters should be a primary focus for quality improvement, and this indicator may be well-positioned to highlight such inappropriate use, particularly in the long-term care setting. Panelists were uncertain of how to identify patients receiving appropriate catheterization using administrative data to facilitate the exclusion of these cases from the indicator. They suggested that patients admitted from a long term care facility will inherently be complicated cases and will often have comorbidities such as renal insufficiencies, diabetes, and cardiovascular conditions.

Angina without Procedure Admission Rate (PQI 13)

Table 23. Angina without Procedure Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	5	Indeterminate	4.5	Disagreement
Overall rating – Payor: public reporting	5	Indeterminate	4	Disagreement
Overall rating – Payor: P4P	4	Indeterminate	4	Indeterminate
Overall rating – PO: internal QI	6	Indeterminate	4	Disagreement
Overall rating – PO: public reporting	5	Disagreement	3	Disagreement
Overall rating – PO: P4P	4	Disagreement	3	Disagreement
Reflects poor access	5	Indeterminate	7	Indeterminate
Reflects poor quality	5	Disagreement	5	Indeterminate
Charting accuracy	6	Indeterminate	6	Indeterminate
Bias	5	Indeterminate	4	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 24. Angina without Procedure Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
Payor	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Some concern regarding use	Yes
	Public Reporting	Some concern regarding use	Major concern regarding use	No
	Pay-for-Performance	Some concern regarding use	Major concern regarding use	No

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Angina without Procedure Indicator

- There may be a substantial increase in use of the ICD-9-CM code for coronary artery disease (CAD) without revascularization procedure for chest pain discharges over the past decade that may directly affect rates measured by this indicator in some datasets (possibly due to reimbursement rates). Along these lines, panelists noted that there is variability in the terminology physicians use to describe chest pain (e.g angina vs. CAD vs. rule out acute myocardial infarction) and in the clinical scenarios which are termed as angina (e.g. any chest pain, chest pain with confirmed CAD).
- The panel briefly discussed the appropriate denominator for this indicator, namely whether to include all patients or only those with known CAD. Some panelists argued that all patients should be included for area level applications, although payor or provider level uses should include only those with previously diagnosed disease. However, the panels tended to focus on other issues with the indicator and did not report a strong consensus on this issue.
- Although self-care is an important aspect of desirable outcomes in patients, the nominal panel was divided as to whether enhanced patient education efforts would increase or decrease admission rates for this indicator. Education may promote desirable self-care behaviors in patients such as adherence to medications, but an appropriate program may also include educating patients to present directly to the emergency department.
- Admitting thresholds for chest pain in the emergency department may be low, possibly due to current legal activity surrounding myocardial infarction. The presence of chest pain centers and observation units as well as inconsistencies in physician terminology with "angina" may contribute to the variation observed across areas or organizations.
- The rate of cardiac procedures across regions of the country may contribute to the variation in admission rates on this indicator. Coding practices and cardiac procedure rates should be examined in conjunction with this indicator.
- As with all chronic conditions, comorbidities and disease severity are of concern. For the Angina without Procedure indicator, patients with diabetes may be particularly difficult to diagnose when presenting with atypical symptoms. Along with risk covariates such as age, race/ethnicity, socioeconomic status, and urban/rural status, further comorbidities for consideration in risk analysis include hypertension, various pulmonary conditions (COPD, pulmonary embolism, asthma, and pneumonia), and mental illness.

- This indicator may serve to expose geographic areas with elevated admission rates for this indicator, and admission rates may be affected by increased access to cardiologists for medication review and cardiac rehabilitation services. Many panelists voiced concern over the current state of evidence regarding contributing factors to the variation observable in admission rates for this indicator across areas. For example, there may be systematic differences in the use of codes and physician terminology, presence of observation units and rates of cardiac procedures, and patient factors outside of the control of the healthcare system.
- Payors may promote education and lifestyle change through increased coverage of programs meant to assist patients in making change (smoking cessation, self-care, participation in regular primary care visits). Panelists did not express confidence in the current state of evidence linking payor organization interventions and the reduction of preventable admissions for this indicator. Applied at the payor organization denominator level, strict consideration of risk covariates and adjustment is needed for proper interpretation of admission rates for this indicator.
- Patient education and follow-up with patients may be implementable interventions for provider organizations to reduce preventable hospital admissions for angina, although panelists debated the potential effectiveness of these interventions. Provider organizations may be positioned to eliminate confounding variation by focusing on consistency in coding and physician terminology. Panelists did not express confidence in the current state of evidence linking provider organization interventions and the reduction of preventable admissions for this indicator. Applied at the provider organization denominator level, strict consideration of risk covariates and adjustment is needed for proper interpretation of admission rates for this indicator.

Adult Asthma Admission Rate (PQI 15)

Table 25. Adult Asthma Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: P4P	6	Indeterminate	6	Indeterminate
Overall rating – PO: internal QI	7	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	5	Disagreement	7	Indeterminate
Overall rating – PO: P4P	6	Indeterminate	7	Indeterminate
Reflects poor access	7	Indeterminate	7	Indeterminate
Reflects poor quality	7	Indeterminate	7	Indeterminate
Charting accuracy	7	Indeterminate	7.5	Agreement
Bias	7	Indeterminate	6	Disagreement

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 26. Adult Asthma Support and Between-Panel Concordance

Denominator	Use	Support Level	Concordance

Level				
		Delphi	**Nominal**	
Area	Public Reporting	Some concern regarding use	Full support for use	Yes
Payor	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Full support for use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Full support for use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Adult Asthma Indicator

- Panelists endorsed restricting the indicator to patients less than 40 years of age. Panelists felt that combining the COPD and Asthma numerator for patients 40 years and older would eliminate the diagnostic uncertainly between asthma and COPD in older patients, and thus provide a cleaner measure. COPD diagnoses in cases under 40 years of age are rare, and therefore, cases of patients less than 40 years are more likely to be true cases of asthma.
- The panel generally felt this indicator reflects issues related to access to quality outpatient care, including affordability of medication and education on proper inhaler use.
- Patient adherence to treatment recommendations remains an issue as with all chronic conditions.
- As with all chronic conditions, comorbidities and disease severity are of concern. For the asthma indicator, other respiratory conditions, infectious disease and cardiovascular conditions are of particular concern. Along with risk factors such as age, race/ethnicity, socioeconomic status, and smoking rates, panelists emphasized that environmental factors may affect admissions rates for this indicator. These environmental factors include pollution levels, altitude, allergens, housing conditions, and occupational exposures from local industries.
- Panelists also generally agreed that the high cost and complicated protocols for inhaler medications present major barriers to patient adherence to treatment recommendations. They further agreed that it is within the ability of the healthcare system to mitigate these barriers, including by providing high quality education on medication needs and inhaler use.
- Panelists felt that this indicator may also reflect some amount of "social" hospital admissions. In other words, cases in which the physician determines that social support or the home environment are insufficient for recovery outside of the hospital. See section 3.5 Lessons Learned for Adapting the PQI for more on considerations surrounding "social" admissions.
- The presence of observation units may affect admission rates.
- Payors may facilitate access to care through increased reimbursement for coverage of inhalers and medications, and by ensuring access to pulmonary rehabilitation and oxygen therapy. Further incentives for patient education regarding the use of inhalers and medications, and incentives for enhanced care coordination may assist in preventing asthma hospitalizations at the payor level. Panelists expressed concern that payors may avoid caring for complex patients as a result of implementing this indicator. Thoughtful risk adjustment and monitoring of patient mix over time is essential.
- There was strong support among panelists for implementing the Adult Asthma indicator at the provider group denominator level for the purpose of internal quality improvement. Provider groups

may be positioned to reduce preventable admissions through enhanced care coordination and patient education efforts. Careful attention should be paid to case mix and adjustment.

Rate of Lower-extremity Amputation among Patients with Diabetes (PQI 16)

Table 27. Diabetes Lower-extremity Amputation Within-Panel Agreement

Questionnaire Item	Delphi		Nominal	
	Median	**Agreement Status**	**Median**	**Agreement Status**
Overall rating – Area: public reporting	7	Indeterminate	7	Indeterminate
Overall rating – Payor: public reporting	6	Indeterminate	7	Indeterminate
Overall rating – Payor: P4P	5	Disagreement	5	Disagreement
Overall rating – PO: internal QI	6	Indeterminate	7	Indeterminate
Overall rating – PO: public reporting	5.5	Indeterminate	4	Disagreement
Overall rating – PO: P4P	5	Indeterminate	4	Disagreement
Reflects poor access	7	Indeterminate	8	Indeterminate
Reflects poor quality	7	Indeterminate	7	Indeterminate
Charting accuracy	8	Agreement	8	Indeterminate
Bias	6	Indeterminate	6	Indeterminate

P4P = pay-for performance, PO = provider organization, QI = quality improvement
See example questionnaire in Appendix B for a guide to these questions and ratings.

Table 28. Diabetes Lower-Extremity Amputation Support and Between-Panel Concordance

Denominator Level	Use	Support Level		Concordance
		Delphi	**Nominal**	
Area	Public Reporting	Full support for use	Full support for use	Yes
Payor	Public Reporting	Some concern regarding use	Full support for use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes
Provider Organization	Internal QI	Some concern regarding use	Full support for use	Yes
	Public Reporting	Some concern regarding use	Some concern regarding use	Yes
	Pay-for-Performance	Some concern regarding use	Some concern regarding use	Yes

QI = quality improvement
An indicator set is not being developed at this time. These summary categories reflect levels of "support" or "concern."

Summary of Qualitative Data for the Diabetes Lower-extremity Amputation Indicator

- Panelists felt that minor problems in the lower extremities can easily be treated with good access to outpatient care, thereby minimizing disease progression. Other issues of access to quality outpatient care related to this indicator include availability/affordability of medications and insulin, availability of physicians (especially specialists), ongoing diabetes education, care coordination, and affordability of other medical supplies (proper footwear and foot care needs). Lower-extremity amputation in diabetes may be related to care issues compounded over an extended period of time.

- Patient factors may limit the control the healthcare system has over admission rates. Self-management behaviors and lifestyle factors (e.g. diet) may particularly affect this indicator. Other patient factors may include time since diagnosis, age, comorbidities, socioeconomic status, geographic limitations (including ambulation and transportation issues), propensity to present in a timely manner, and cultural differences or beliefs.
- Some patients may have advanced disease upon enrollment with a payor or provider organization. Thus a resulting admission for the Diabetes Lower-extremity Amputation indicator may not clearly be attributable to care practices associated with the organization. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Currently, both type 1 and type 2 diabetes ICD-9-CM codes are included in the definition of the diabetes short-term complications indicator. Arguments in favor of separating type 1 and type 2 patients in the denominator included: a) differing etiology and complications between the conditions, and b) prevention goals with type 2 may be more attainable. Arguments against separating the conditions in the denominator included: a) quality care outcomes may not differ between the conditions, and b) ICD-9-CM codes used in these measures are not always reflective of the true clinical condition as patients may be mistakenly assigned codes from either type 1 or type 2. This variation in coding may be related to factors such as age (type 1 patients receiving type 2 codes when they reach adulthood), insulin prescription or type of procedure the patient receives. Panelists endorsed including both type 1 and type 2 diabetes together.
- It was suggested that as many as 50% of toe and forefoot amputations may now be performed on an outpatient basis, and thus one may consider excluding these amputations. However, panelists did not support such an exclusion, but noted that monitoring outpatient procedures may be important.
- Panelists expressed some concern that aggressive incentives to treat foot ulcers with non-surgical methods to avoid elevated admission rates for this indicator may increase inappropriate non-surgical treatment (for non-healing ulcers, etc.).
- The panels strongly supported using this indicator to measure and compare admissions rates across geographic areas as many areas may benefit from increased targeting of resources related to this indicator. In addition to attention to risk factors and rates of smoking, panelists noted that the transience of patient populations across geographic areas may make conclusions about admission rates for this indicator difficult. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- Panelists expressed concern that pay for performance initiatives at the payor and provider level may incent adverse selection of complex patients.
- Payor organizations in particular may be able enhance coverage of medication, supplies for continued diabetes self-management, and coordinated care efforts. Payor organizations may also encourage patient education for self-management. Careful attention should be paid to case mix and adjustment. In addition, panelists suggested using a minimum patient tenure to qualify for the denominator. Rates of smoking within the patient population may also be of value if the data are available. See section 3.5 Lessons Learned for Adapting the PQI for more information.
- There was some concern that the current reimbursement structure may not incentivize the highest quality management possible for diabetes patients at elevated risk for amputation. For example, reimbursement for below knee amputation may currently be more financially beneficial to providers overall than providing the limb-salvaging techniques described above.
- Provider organizations in particular may be able to enhance care coordination efforts for diabetes patients. Panelists noted that these programs may not be sustainable without increased funding. Careful attention should be paid to case mix and adjustment. In addition panelists suggested using a

minimum patient tenure to qualify for the denominator. See section 3.5 Lessons Learned for Adapting the PQI for more information.

3.2 Results by use

Tables 29-31 summarize the results by use and denominator level. Overall, panelists showed more support for Quality Improvement applications than for Comparative Reporting. Pay for Performance garnered the least support.

Use for Quality Improvement (QI)

Panelists showed more support for internal quality improvement use than for other applications, with three indicators earning "Full Support for Use": Diabetes Short Term Complications, Asthma Admission Rate and Congestive Heart Failure. Four other indicators (COPD/Asthma Age >40 yrs, Hypertension, Diabetes Long Term Complications, Lower Extremity Amputation in Diabetics) received "general or full support" ratings by either the Nominal or Delphi Panel, but the other panel showed some concern for use. Panelists had major concerns regarding the use of Perforated Appendix and Dehydration, except when applying the latter to long term care settings. For the Long Term Care setting, panelists supported the use of Urinary Tract Infection and Dehydration, and one panel supported the use of Bacterial Pneumonia.

Use for Comparative Reporting

Panelists felt that comparative reporting for many of the indicators may expose areas in need of additional resources, although support for use of the indicators for comparative reporting was only modest. Only three indicators were rated as "Full Support for Use" for comparative reporting: Lower Extremity Amputation in Diabetes for area-level reporting, Congestive Heart Failure for provider-level reporting, and Dehydration for long term care reporting. Both panels rated Perforated Appendix as "Major Concern Regarding Use" for all reporting levels, and Dehydration was rated as "Major Concern Regarding Use" by one panel for payor- and provider-level reporting. Panelists rated all other indicators as "Some Concern for Use" for comparative reporting at the area, payor and provider levels. Support for comparative reporting in long term care was greater, although this was evaluated for only three indicators.

For all comparative reporting applications, panelists emphasized the need for careful risk adjustment (see section 3.4 "Results of the Risk Adjustment Evaluation). In addition, panelists noted that for many indicators, practice patterns should be taken into consideration when making comparisons across areas. In particular, they expressed concern that different thresholds for admission and varying use of observation units might impact rates of some indicators. They also emphasized that higher stakes use may encourage patient selection practices or changes in coding behaviors. It would be important to monitor for such adverse effects of implementation (see section 3.5 Lessons Learned for Adapting the PQI).

Use for Pay for Performance

Panelists showed comparatively less support for using these indicators in Pay for Performance applications. At the payor level, no indicators were rated higher than "Some Concern Regarding Use," with the exception of Hypertension which was rated "General Support with Concerns" for by one panel.

For all pay for performance applications, panelists emphasized the need for careful risk adjustment (see section 3.4 "Results of the Risk Adjustment Evaluation). They also emphasized that higher stakes use may encourage patient selection practices or changes in coding behaviors. It would be important to monitor for such adverse effects of implementation (see section 3.5 Lessons Learned for Adapting the PQI).

Even with the best application of these indicators in Pay for Performance initiatives, panelists still expressed concern regarding their use. They noted that the control that health care providers have to prevent hospitalizations may be outweighed by patient behavior and compliance. Although programs may mitigate these effects, the panelists also noted that such programs are very expensive and these expenses are likely to overshadow any financial incentive offered for Pay for Performance initiatives. This was noted particularly for providers that care primarily for low income, at-risk patients.

Table 29. Results by Indicator for Quality Improvement Uses

Indicator	Provider	Long-Term Care
COPD and Asthma (40 yrs +)	▲▲ +	Not evaluated
Asthma (< 39 yrs)	▲▲▲▲	Not evaluated
Hypertension	▲▲ +	Not evaluated
Angina	▲▲	Not evaluated
CHF	▲▲▲▲	Not evaluated
Perforated Appendix	▲+	Not evaluated
Diabetes Short Term Complications	▲▲▲▲	Not evaluated
Diabetes Long-Term Complications	▲▲+	Not evaluated
Lower Extremity Amputation in Diabetics	▲▲+	Not evaluated
Bacterial Pneumonia	▲▲	▲▲ +
UTI	▲▲	▲▲▲+
Dehydration	▲+	▲▲▲▲

▲ Major Concern Regarding Use
▲▲Some Concern
▲▲▲General Support
▲▲▲▲Full
+ Either Delphi or Nominal Panel reported higher level of support for measure than shown
COPD = Chronic Obstructive pulmonary disease, CHF = Congestive Heart Failure, UTI = Urinary Tract Infection

Table 30. Results by Indicator for Comparative Reporting Uses

Indicator	Area	Payor	Provider	LTC
COPD	▲▲	▲▲	▲▲+	Not evaluated
Asthma (< 39 yrs)	▲▲+	▲▲+	▲▲+	Not evaluated
Hypertension	▲▲+	▲▲+	▲▲	Not evaluated
Angina	▲▲	▲▲	▲	Not evaluated
CHF	▲▲+	▲▲+	▲▲▲▲	Not evaluated
Perforated Appendix	▲+	▲+	▲+	Not evaluated
Diabetes Short Term Complications	▲▲	▲▲+	▲▲+	Not evaluated
Diabetes Long-Term Complications	▲▲+	▲▲	▲▲	Not evaluated
Lower Extremity Amputation in Diabetics	▲▲▲▲	▲▲+	▲▲	Not evaluated
Bacterial Pneumonia	▲▲	▲▲	▲▲	▲▲+
UTI	▲▲	▲▲	▲▲	▲▲▲+
Dehydration	▲▲	▲+	▲	▲▲▲▲

Table 31. Results by Indicator for Pay for Performance Uses

Indicator	Payor	Provider	LTC

COPD	▲▲	▲▲+	Not evaluated
Asthma (< 39 yrs)	▲▲	▲▲+	Not evaluated
Hypertension	▲▲+	▲▲	Not evaluated
Angina	▲▲	▲+	Not evaluated
CHF	▲▲	▲▲	Not evaluated
Perforated Appendix	▲	▲+	Not evaluated
Diabetes Short Term Complications	▲▲	▲▲	Not evaluated
Diabetes Long-Term Complications	▲▲	▲▲	Not evaluated
Lower Extremity Amputation in Diabetics	▲▲	▲▲	Not evaluated
Bacterial Pneumonia	▲▲	▲▲	▲▲
UTI	▲+	▲+	▲▲+
Dehydration	▲+	▲	▲▲▲▲

3.3 Results by Denominator Level

Panelists did not favor any one denominator level: area, payor or provider. However, panelists did suggest that a fourth denominator level be considered, namely long term care facilities. They suggested that long term care facilities often have more impact over lifestyle, compliance with treatments, medical care utilization and other factors affecting health than the healthcare system does for community dwelling patients. As a result, that setting is ideal for monitoring quality of care through preventable hospitalization rates.

Although panelists did not rate any denominator level higher overall than other levels, they noted that the denominator level should be considered when applying the indicators. They raised specific concerns, which are summarized in Table 34 and further discussed in the section 3.5 "Lessons Learned for Adapting the PQI." In addition, panelists noted that the potential impact on hospitalization rates varies by denominator level. Table 32 summarizes the interventions that panelists viewed as potentially useful in reducing hospitalization rates by denominator level.

Table 32. Potential Interventions to Reduce Hospitalizations

	Acute	**Chronic**
Area	• Access to primary care/urgent care	• Lifestyle modifications (access to healthy living, education and advocacy campaigns)
Payor	• Coverage of medications • Coverage of auxiliary health services (e.g., at home nursing) • Access to primary care/urgent care	• Coverage of medications • Coverage of comprehensive care programs • Coverage of auxiliary health services (e.g., at home nursing) • Disease management programs • Lifestyle modification incentives
Provider	• Quality nursing triage • Patient education • Accurate and rapid diagnosis and treatment • Appointment availability • Outpatient treatment of complications	• Education, disease management • Lifestyle medication interventions • Comprehensive care programs, care coordination, auxiliary health services

3.4 Results of Risk Adjustment Evaluation

Overall, panelists rated all covariates presented as at least somewhat important to include in a risk adjustment model (range of means = 2.3–3.8 on 4 point scale). Panelists tended to favor covariates that included data from the year prior to the hospitalization of interest, rather than those that take a more historical look at patients (at intake into a program or within 12 month period 3 years prior for those enrolled more than 3 years). Both panels rated the importance of four covariates very highly, namely comorbidities within the past year (mean Delphi/Nominal = 3.2/3.2, SD = 1.0/0.5), gender (mean = 3.0/3.1, SD = 0.8/0.9), age (mean = 3.6/3.8, SD = 0.7/0.5), and socioeconomic status measured by median income in patients zip code (mean = 3.2/3.1, SD = 0.8/0.7). The Delphi Panel also rated prior hospitalizations within past year highly (mean = 3.3/2.8, SD = 0.8/1.1). See Table 33. Further discussion of risk adjustment issues can be found in section 3.5 Lessons Learned for Adapting the PQI.

In free text comments panelists noted that the importance of each covariate is primarily dependent on the indicator. They also stressed the importance of risk adjustment. Panelists noted that pharmaceutical data could reflect both severity of disease (e.g., more prescriptions filled means higher severity of disease), or better adherence to treatment (e.g., more prescriptions filled indicates likely better adherence). They also raised factors such as the urban or rural status, and environmental factors that may track with socioeconomic status (SES) but are not related to quality of care, such as job-related or environmental pollution.

Table 33. Panel Ratings of the Importance of Specified Covariates in Risk Adjustment

Questionnaire Item	Delphi		Nominal	
	Mean	**SD**	**Mean**	**SD**
Comorbid diagnoses codes within past year	3.2	1.0	3.2	0.5
Prior hospital admissions within past year	3.3	0.8	2.8	1.1
Prior ED visits within past year	3.0	0.8	2.6	1.0
Pharmaceutical use within past year	2.9	0.8	2.6	1.1
Comorbid diagnoses codes at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*	2.9	0.7	2.9	0.9
Prior hospital admissions at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*	2.8	0.8	2.4	0.8
Prior ED visits at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*	2.8	0.8	2.3	0.9
Socioeconomic status (measured by median income in patient zip code)	3.3	0.8	3.1	0.7
Race	2.8	0.9	2.8	0.9
Age	3.6	0.7	3.8	0.5
Gender	3.0	0.8	3.1	0.9
Need for Interpretation Services	2.8	0.9	2.5	0.8

Consistent versus changing payor coverage over past 3 years	2.8	1.0	2.7	0.7

1: Not at all important , 2: Somewhat important , 3: Very important , 4: Essential

*For these data, one would use one of two time periods to determine severity of disease at intake into the plan or medical group. The intent is to determine severity of disease before the health plan or physician began providing services.

1. For patients enrolled within the past 3 years, the data at intake and the following 12 months (as available) would be used for risk adjustment.

2. For patients enrolled longer than 3 years, in order to reduce burden of data collection, data from the intake year would not be feasible. For this reason, we will consider data from a 12 month span, collected 3 years prior to the hospitalization.

3.5 Lessons Learned for Adapting the PQI

Panelists emphasized that the usefulness of the indicators depends on the proper application of the indicator. This includes determining the indicators that best fit the application, selecting data sources, modifying the numerator as needed, determining the most appropriate denominator, determining risk adjustment and finally monitoring the data for true quality improvement. Table 34 summarizes the issues raised by the panelists by denominator level and suggests potential remedies for these concerns. Users wishing to adapt the PQI will need to consider each of these factors carefully, in light of their own purposes, data and audience. It is unclear from this panel process how the choices made in implementing the indicators would impact the consensual validity of the indicators. Below, panelists' comments are summarized for each of these topics.

Table 34. Concerns regarding the adaptation of the PQIs and potential remedies

	Special issues	Potential Remedies
Area	• Distinguishing access to care issues from quality of care • Appropriate to include effects of long-term chronic disease (e.g., long term diabetes) • Out of area admissions/ geographic border admissions	• Utilize service area data, even when areas cross geographic borders
Payor	• Appropriate identification of denominator group • Transience of members • Risk stratification/adjustment: Disease severity and lifestyle associated risk factors • Potential to deny coverage for high risk patients	• Include only patients with more than a single occurrence of a diagnosis code • Consider minimum tenure with payor organization for inclusion • Provide SES adjusted or stratified rates in conjunction with disease severity adjustment • Track patient risk factors over time
Provider	• Appropriate identification of denominator group • Transience of members • Variation in coding practices • Risk stratification/adjustment: Disease severity and lifestyle associated risk factors • Potential to avoid care for high risk patients	• Include only patients with more than a single occurrence of a diagnosis code • Consider minimum tenure with provider organization for inclusion • Consider adding related diagnoses present in the principal diagnosis position • Provide SES adjusted or stratified rates in conjunction with disease severity adjustment • Track patient risk factors over time

Selecting the Indicators

1. The transient nature of a population impacts the validity of the indicators. For instance, if a provider experiences high patient turnover, then complications that result from poor care over time, such as long-term diabetes complications, are not clearly attributable to the care of that provider. Instead, poor care from previous providers may have led to worsening disease and resulting complications. However, area level applications that emphasize access to quality care for a population may appropriately include indicators that capture complications of poor long term care. Indicators that panelists highlighted as particularly sensitive to long term quality care included long term diabetes complications and lower extremity amputation in diabetics and to a lesser extent COPD and CHF.

Defining the Numerator

1. Some patients are repeatedly admitted for the same condition. Overall, our panels felt that capturing every admission for the same patient would lead to misleading rates. They advocated for capturing only the first admission within one year. Users will need to consider how to treat multiple admissions from one patient.
2. Differences in coding or terminology may impact the ability to compare areas, payors or especially providers. In some cases alternative diagnoses could be used in the principal position, while the target diagnosis is used in a secondary position. For some indicators, such as dehydration, the panel suggested including cases with a secondary diagnosis of the target condition, but a related principal diagnosis. Details can be found in the individual indicator summaries in section 3.1. The actual use of the indicators may impact whether or not these alternative diagnoses should be included. In general, the panels advocated for broader inclusion criteria when measuring area level access to care for chronic conditions. For instance, users may choose to add in other manifestations of hypertension, such as stroke or renal failure when tracking area level access to care. It should be noted that such vastly expanded definitions have not yet been tested.
3. Including the first hospitalization for a chronic condition, prior to which the patient has not had a diagnosis for the target condition, may or may not be desirable. Panelists noted that for some conditions, such as short-term diabetes complications associated with Type 1 diabetes, these complications may be unavoidable and admissions may reflect the highest quality of care. On the other hand, many of these conditions do not present with a serious complication requiring hospitalization, but rather lend themselves to early detection through screening and regular medical care. In these cases, some argue that complications that result in hospitalization could be avoided through adequate access to high quality care, and thus the first hospitalization for a chronic condition should be included.

Defining the Population at Risk

1. When feasible, it is best to identify the most specific population at risk. In the case of the chronic disease indicators, this is usually patients with a prior diagnosis of the target chronic disease (e.g., COPD, CHF, diabetes). For some conditions, such as hypertension and diabetes, panelists were particularly concerned that a single incidence of that diagnosis code might be inaccurate. Instead, panelists suggested that only patients with at least 2-3 separate encounters with the target diagnosis code be used for all chronic condition indicators.

2. Area level applications will be affected by the underlying burden of chronic disease in an area. Where possible, area level disease burden should be used to identify the denominator. Since this is unavailable for most conditions and geographic units, users should consider risk adjustment approaches.
3. Pharmaceutical data may help to identify patients with chronic obstructive pulmonary disease, asthma and diabetes. However, it is important to note that these medications may be used for other purposes such as infection related wheezing, secondary diabetes, or polycystic ovarian syndrome.
4. The patient population for a payor or provider group may be subject to high turnover. In these cases the complication or worsening disease may not be attributable to the current payor or provider, but instead may be due to poor care or access from a previous payor or provider. Users should consider the minimum tenure with a payor or provider before including a patient in the denominator. This might vary by indicator, where short term or acute complications would require a shorter tenure than those which take more time to develop.

Implementing Risk Adjustment

1. Panelists emphasized that risk adjustment is essential for any indicator when comparing areas or groups, and especially when utilizing the indicator in pay for performance initiatives. Risk adjustment generally includes the following factors, each discussed below: disease severity, comorbidity, lifestyle-associated risk factors and compliance, and socioeconomic status.
2. Panelists indicated that important risk factors may vary by indicator. For instance, race was cited as a particularly important risk factor for peripheral artery disease (i.e., Lower Extremity Amputation in Diabetics), but was considered less important for other indicators.
3. Disease severity is an important and complex issue in risk adjustment. On one hand, disease severity clearly impacts the risk of hospitalization for almost all chronic diseases. In this case, one would clearly want to adjust for severity of illness. On the other hand, poor quality care or poor access to care can accelerate disease progression. In this case, adjusting for disease severity may mask disparities in access to quality care. One approach would be to adjust for disease severity at intake into a payor or provider system, which would then highlight disease progression which occurred under the care of that payor or provider. Since data burden would be extensive for patients that have been enrolled for a long period of time, we suggested that either disease severity at intake or at three years prior to measurement could be used. Panelists rated this historical data as less useful than up-to-date data on disease severity. Although most panelists did not comment as to why they felt historical data was less useful, some commented that data burden outweighs the benefit derived from using historical data and that since these diseases are progressive, using historical data may miss severity that is not due to quality care.
4. Data that could be used to estimate disease severity include prior hospitalizations, emergency room encounters and pharmaceutical use. For data from the year prior to measurement, panelists rated prior hospitalizations as the most important to include in a risk adjustment system, but for historical data (at intake or three years prior) all three sources were rated similarly. Panelists noted that pharmaceutical data could include either prescriptions issued or prescriptions filled. The former may be a better indication of severity, while the latter may better reflect compliance with therapy.
5. Along with socioeconomic status, comorbidity was the most highly rated covariate for inclusion in a risk adjustment model. We did not explore specific definitions or algorithms of comorbidity in this study.

6. Panelists repeatedly cited lifestyle-associated risk factors such as smoking, diet, activity level and issues of compliance as important factors influencing admission rates. Although panelists noted that interventions such as smoking cessation programs, interventions to overcome language barriers, and culturally sensitive patient education on medication use and the importance of compliance, may decrease these risk factors, they also felt that the health system has limited impact. For area level applications, underlying smoking and obesity rates may be utilized when available. When available, panelists noted that prescriptions filled as compared to prescriptions issued may be one method of assessing patient compliance.
7. Since patient risk factors, poor compliance and environmental risk factors tend to occur at higher rates in lower socioeconomic strata, panelists noted that adjustment for socioeconomic strata is desirable and rated its importance higher than any other risk adjuster. Panelists confirmed that patients with fewer economic and social resources may fail to comply with medication or other therapy or attend follow-up appointments despite the best efforts of the health care system. These patients may require more intensive medical care in order to ensure compliance and improve outcomes, including so-called "social" hospital admissions. Although panelists conceded that adjusting for socioeconomic status may mask disparities in access to quality of care, they also noted that when using the indicator to compare payor and provider groups, SES risk adjustment is essential to ensure fair comparisons. Panelists argued that failing to do so would unfairly disadvantage payors and providers that care for this difficult population and could lead to less access for these patients. Several panelists had particular concern for homelessness as a risk factor.
8. Panelists rated all of the potential risk adjusters as important. In addition to covariates already discussed, panelists rated as important: race, age, gender, need for interpretation services and consistent vs. changing payor coverage over past three years.

Determining Data Sources

1. Outpatient ICD-9-CM data may need to include several years in order to identify patients with chronic disease.
2. Historical data may be useful for risk adjustment, although panelists rated recent data as more important.
3. Pharmacy data may be used to rate severity of illness (number of prescriptions) or compliance (number of prescriptions filled)
4. When applying an area level denominator, hospitalizations may be undetected when they occur near a geographic border (e.g. another state or county). In this case, using service area data may be more appropriate.

Monitoring for True Quality Improvement

1. Panelists noted that in some cases shifts in coding practices can lead to changes in indicator performance without true quality improvement. They noted that some indicators, such as dehydration and angina, are particularly sensitive to these coding changes and as such, users may wish to monitor for shifts to related codes for these indicators.
2. Panelists expressed concern that use of these indicators will lead to poorer access to care for high risk patients. As such, many panelists suggested that the case mix of payors and providers be monitored for shifts to less complex patients over time.

4.0 Discussion and Next Steps

Although our primary purpose was to assess the additional applications of these indicators, we did ask panelists to rate the current application, area-level reporting. Panelists expressed some concern regarding the usefulness of the indicators even for area level application. Since panelists generally represented experts in clinical care, rather than community or public health, it is difficult to draw conclusions from their concerns, other than to note that clinicians in general seem to be cautious about attributing hospital admission rates to poor access to quality outpatient care.

Regardless of the application, panelists generally felt skeptical about utilizing these indicators in pay for performance initiatives. They cited the strong correlation with socioeconomic status and patient compliance as factors out of the hands of providers or payors. They worry that providers and payors may avoid caring for underprivileged or other clinically complex patients. Instead, panelists advocated for process-based measures of compliance with guidelines. There is tension between the desire for process-based measures and those which demonstrate actual improvements in patient outcomes, but are subject to more noise due to factors outside the control of the healthcare system. In addition, panelists noted that the cost of programs which reduce hospital admissions are likely to be higher than the rewards for preventing admission, and therefore expressed skepticism that pay for performance would provide incentives for such quality care.

When considering acute condition indicators, namely Bacterial Pneumonia, Dehydration and Urinary Tract Infection, panelists suggested that application to Long Term Care settings may be more appropriate, since patients in these facilities are more closely monitored and have more of their care under institutional control. In fact, overall they rated these applications more favorably than any other application. However, since few of our panelists provided care in a Long Term Care setting, this evaluation needs to be repeated with other experts.

The fact that our review only included one stakeholder group, that of clinicians, needs to be emphasized. This group only provides one perspective. It is essential that future research explore the opinions of additional groups, including those solely involved in public health, consumers, and others involved in the quality debate. In general, clinicians may be more focused on patient level care than on system level evaluations. This may color their opinions about the usefulness of these indicators. Second, clinicians may underestimate the impact of the healthcare system as a whole on modifying lifestyle risk factors or compliance in high risk groups, based on their own experience working with these patients with limited financial and temporal resources, as well as limited expertise in these particular matters.

The clinical group does provide important expertise that allows for the refinement of indicator definitions based on clinical considerations. In this review, we assessed only the theoretical face validity of expanding the uses of the PQIs to additional denominator levels. However, as the panels discussed, such expansion has many implications for the specific implementation of the indicators. In this study, we did not discuss the impact of definitional permutations or specific risk adjustment models on the consensual validity of the indicators. In addition, we did not explore the feasibility of defining the indicators using outpatient administrative data from provider or payor organizations. Investigating the feasibility using outpatient administrative data, constructing these potential indicators, and subsequently investigating the consensual validity of the specific definitions and risk adjustment models is an essential next step.

Our review also primarily assessed these indicators as reflecting access to high quality care, without a specific focus on the value of care. Since policy makers have raised preventable hospitalizations as one

way to improve both quality and save costs, some of the panelists' comments should be highlighted. Panelists noted that the cost of interventions attempting to prevent these hospitalizations may be substantial. For instance, comprehensive care programs or lifestyle modification programs that have substantial impact on outcomes may be very resource intensive. In some cases these costs may outweigh the cost of the actual hospitalizations. In cases where disease progression and resulting complications are slowed, this would reflect an increased quality of care, even though costs would rise. However, in some cases, hospitalization does not reflect progression of disease and therefore cost may rise without corresponding improvements in patient outcomes. These tradeoffs could be considered in future research.

Despite concerns, many panelists expressed some support for these indicators. In addition, only one indicator of twelve was rated so unfavorably by both panels that they should be used with extreme caution in any application. The concerns expressed reflect that the details of application are of utmost importance when using these indicators. This requires additional research to define the most appropriate denominator populations, identify and test appropriate risk adjustment, and understand the usefulness of these indicators in improving access to quality outpatient healthcare. When issues of risk adjustment, denominator definition and data collection burden are addressed, the usefulness of these indicators for expanded application would likely improve.

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APPENDIX A: Example literature review and admission rate comparison using 2005 Nationwide Inpatient Sample data.

Example Literature Review

Literature Review Detailed Summaries for Diabetes Related Indicators

Indicator: Diabetes Short-term Complications Admission Rate (PQI 1)

Evidence from the literature

Face validity. Diabetic ketoacidosis, hyperosmolarity (HHNS), and coma are life-threatening complications of diabetes mellitus, particularly type 1 or insulin dependent diabetes mellitus (IDDM). Diabetic emergencies arise when there is an excess of glucose or insulin. The balance of insulin and glucose is kept by proper administration of insulin, and may involve other activities such as home blood-glucose monitoring. It has been noted in an adolescent and young adult population that better adherence to treatment (actual insulin intake vs. prescribed intake) is associated with fewer admissions for ketoacidosis and other complications.[1] Education programs for patients with diabetes have mixed results on reducing admissions for diabetic emergencies, though some have been shown to be effective.[2] It is important to note that intensive treatment (continuous insulin infusion pump, or multiple insulin injections daily) has been associated with more admissions for hypoglycemia.[3] Such intensive treatment has not been shown to have impact on admissions hyperglycemic events, but does reduce the incidence of long-term complications. Both hypoglycemic and hyperglycemic events are included in this indicator.

Racial disparities in diabetes related hospitalizations have been reported. Spanning 1991-1998, California hospitalization rates were almost 10 times higher among African Americans men and women than among Asian men and women.[4]The Urban Diabetes Study described a cohort of 18,800 low-income, ethnically diverse diabetic patients in Philadelphia, PA healthcare centers. Hispanic (0.27 admissions per year) and Asian (0.13 admissions per year) had lower overall hospitalization rates than non-Hispanic Whites (0.27 admissions per year) or African Americans (0.36 admissions per year).[5]

Reliability and Variance. An ecological study performed in Ontario, Canada compared acute diabetes complication rates over time, adjusting for geographic factors. Utilizing linked administrative and census data, the primary outcomes of interest were hyper- or hypoglycemia-related hospital admissions and ED visits for diabetes. Booth et al. demonstrated decreases of 33% and 75% for hyper- and hypoglycemia-related admissions, respectively, although these decreases could not be linked to any specific interventions.[6] In a study in Victoria, there was a 12-fold variation in admission for diabetes complications rates for diabetes complications across Primary Care Partnership (PCPs), with 13 PCPs having significantly higher rates than Victorian average.[7]

Minimum bias. Some areas, payors or providers may have higher rates of diabetes, due to ethnic or age composition. It would be expected that these areas would have higher admission rates for diabetic emergencies. Other factors, such as illness,[8-10] may also predispose patients to be admitted for diabetic emergencies. However, it is unlikely that any one area would experience significantly higher rates of these factors.

Admissions for diabetic emergencies can occur in both patients with existing and treated diabetes, as well as patients with previously unknown diabetes. One New Zealand study of 196 patients admitted for DKA found that 20% of admissions were new onset diabetes.[11] Two separate US studies of a US Urban African-American population found that 25% and 17% patients admitted for DKA were reportedly new onset diabetes.[8, 9]

Older age is associated with higher rates of underlying illness, more severe DKA, and better pre-hospitalization glycaemic control. This indicates that older patients may have fewer compliance issues and more complex cases.[10]

Criterion validity. As part of a retrospective evaluation of a diabetes management program, the agreement between self-reported and insurance claim data on hospitalization and emergency room utilization was examined. The percentages of participants whose self-reported hospitalization and emergency room utilization exactly matched

data derived from insurance claims were high (89.1% and 87.2%, respectively). Furthermore, the kappa statistics of agreement for the number of hospitalizations (0.6366) and emergency room visits (0.5390) indicate good agreement between self-reported and insurance claim data.[12]

Construct validity. Precipitating events leading to admission may include physiologic causes, as discussed above, or the cessation of treatment due to access to care or non-compliance issues. Evidence that such causes are or are not due to access to care contributes to the construct validity of this indicator. However, such evidence has not been strongly shown. Some studies outside the US, and a few inside the US have examined the precipitating events of admission for diabetic emergencies. These studies often rely on self-report, which may be a biased measurement in and of itself. Of patients with previously known and treated diabetes, over 60% had made an error in insulin administration or had omitted insulin. Few of these patients also had underlying illness. Further, 25% of the original patients were readmitted within the 18-month study period. This study has no indication whether or not these errors were due to non-compliance, poor education, or access to care problems.[11] A Scottish study of young adult patients found that 42% of DKA admissions were due to lack of adherence to insulin treatment.[10]

In a potentially underserved population of Urban African-Americans, 2/3 of admissions were due to cessation of insulin therapy. Half of the patients stopping insulin treatment reported financial or other difficulties in obtaining insulin, while 21% reported inadequate understanding in adjusting dosages with food intake, and 14% were unsure about insulin management on sick days. Fourteen percent were clearly non-compliant. Most patients reported having been educated in diabetes care.[8] In a related study at a later date, 49% of patients with DKA, and 42% of patients with HHNS stopped or inadequately administered insulin prior to the diabetic emergency.[9]

In a retrospective cohort study, Hepke et al. found that pharmaceutical therapy adherence among 57,867 diabetic patients enrolled in a Preferred Provider Organization sponsored by Blue Cross Blue Shield of Michigan was associated with fewer ED visits and inpatient admissions. Compared with patients without any diabetic drug claims (0% adherence), patients with an adherence level of 1-19% or 20-39% were 1.26 and 1.23 times more likely to have an inpatient admission overall. Patients with any level of drug adherence (1-100%) were 1.78 to 4.32 times as likely to have a diabetes-related inpatient admission than patients with zero adherence.[13]

Recent studies have examined interventions aimed at improving diabetic glucose control and reducing hospitalization. In a clustered randomized intervention study in Australia, diabetes recall system as well as staff training for basic diabetes care, regular phone calls, a twice-monthly newsletter and a mid-project workshop were established over one year. The intervention group showed a 32% reduction in hospital admissions for diabetes-related conditions over the study period ($p = 0.012$). At follow-up, patients in intervention sites were 40% less likely to be hospitalized for a diabetes-related condition than those in control sites (RR = 0.60, 95% CI, 0.41-0.86; $p = 0.007$). In another article, a two-year follow up of the same study was reported. The authors found that the proportion admitted to hospital with diabetes related conditions fell from 25% to 20% and also most of the indicators remained sustained two years after the intervention.[14-16]

A prospective cohort study (n = 191) of young adults (15-25 years) evaluated a "transition support programme," designed to assist young adults as they transitioned from pediatric to adult health services. Outcome variables measured were HbA1c levels during clinic visits, hospitalizations for diabetic ketoacidosis (DKA), and length of stay (LOS). An increase in glycemic control was demonstrated by a mean HbA1c reduction of 0.13% per visit ($p = 0.01$) across the first four visits in a linear mixed effects model. There was a statistically significant reduction in admissions rates with DKA (incidence density = 0.62, 95% CI, 0.39-0.99).[17]

The effect of a nurse-directed diabetes management program on a minority population cared for at a Los Angeles County public health clinic was assessed using a retrospective cohort design. In a cohort of 331 patients, mean hemoglobin A1c levels fell from 8.8% to 7.1% after one year. Total charges for diabetes related urgent care/ER visits and hospitalizations fell from $129,176 in the year before the intervention to $24,630 in the year after the intervention ($p < 0.001$). The sample was too small to show a significant reduction in admission rates.[18]

A large retrospective cohort study of diabetes patients in a private clinic system in Houston in 2002 (n = 10,980) examined the association between participation in a primary care diabetes management program and risk of hospitalization. The 23.5% of patients who participated in some type of diabetes care management program experienced a 16% reduction in the likelihood of hospitalization (odds ratio = 0.84, 95% CI, 0.70-1.0). Participation in a specific diabetes education session was also associated with a significant reduction hospitalization risk (OR = 0.69, 95% CI, 0.49-0.96); however, the effect was limited to patients in the controlled HbA1c stratum (<9.5%).[19]

A randomized control trial conducted in Seoul, Korea recruited type II diabetic inpatients (n = 437) and randomly allocated them into a structured intensive diabetes education program (SIDEP) or usual care. The SIDEP curriculum (intervention) involved seven hours/day for five days of education on all aspects of diabetes self-care. During the four years of follow up, the intervention arm had significantly higher scores than the control group for all three self-care behaviors: diet ($p < 0.001$), self monitored blood glucose (SMBG) ($p < 0.001$), and physical activity ($p < 0.004$). The mean hemoglobin A1c of the SIDEP group was lower than that of the usual care group, by 0.87 at 6 months, 0.28 at 2 years, 0.51 at 3 years, and 0.80 at 4 years. The frequency of diabetes-related admission was significantly lower in the SIDEP group than in the usual care group (i.e., median 1.0 vs. 0.8 per patient), although the most common cause was infection rather than hyperglycemia per se.[20]

To assess impacts of community health workers (CHWs) on healthcare utilization of African American Medicaid patients with diabetes mellitus claim files were analyzed from 1992 to 1994. Total ER visits declined by 40%; ER admissions to hospitals declined by 33%, as did total hospital admissions.[21]

Two studies examined participation in specialized diabetes care clinics and hospitalization. An ecological study performed in Piemonte, Italy using secondary data tested the effect of specialized diabetes care on hospitalization rates for diabetes. The authors found that the standardized hospitalization rate at the local health unit level was directly associated with the number of hours of specialty care (R-squared = 0.464, p = 0.0019). However, patients who received a high average number of hours of diabetes care (>0.9 hours per week per 1,000 inhabitants) were significantly less likely to have an emergency/unplanned hospital admission (OR; $CI_{95\%}$) (0.37; 0.20, 0.67) and spent fewer days in the hospital on average (-0.26 days; 95% CI, ¯0.45 - ¯0.06), independent of socioeconomic level.[22] In another retrospective cohort study, Huang et al. investigated health care utilization among type II diabetic patients treated in diabetes centers (DC, n = 127) and general medicine clinics (GMC, n = 456) at Massachusetts General Hospital. Patients were identified based on ICD-9-CM coding from outpatient clinic visits and a randomly selected subset of records was abstracted. DC patients had a longer mean duration of diabetes (12 vs. 6 yrs, $p < 0.01$), more baseline microvascular disease, (65 vs. 44 %, $p < 0.01$) and higher baseline glucose levels (HbA1c 8.6 vs. 7.9 %, $p < 0.01$) than GMC patients. In all analyses comparing inpatient and emergency room visits, no significant differences in cost or utilization outcomes were found, even after adjusting for age, gender, race, duration of diabetes, baseline glucose level, number of medications, comorbidities, and insurance status (e.g., odds ratio for hospitalization = 0.88; 95% CI, 0.52-1.49).[23]

A few studies have failed to show an association between glucose control or interventions aimed at improving control, and hospitalization. By means of administrative data and in a historical cohort study in Seattle, diabetic patients whose HbA_{1c} improved from 1992 through 1997 didn't show a significant difference in hospitalization. However improvement in HbA_{1c} was associated significantly with cost saving within 1 to 2 years of improvement.[24] Petitti et al. showed that a program of performance monitoring and feedback conducted in a large group model HMO on 63,264 diabetic patients was associated with modest improvements in several measures of better process of care. In this setting no immediate return was evident in terms of lower overall hospitalization for MI, stroke or lower-limb amputation.[25] Also, a controlled trial of a multifaceted intervention in support of diabetes treatment guidelines vs. usual care, found no effect on health care utilization or costs and control.[26] Using administrative data from March 1996 to October 2000, the probability of a hospitalization, and the probability of an emergency room visit associated with a diabetes center (DC) and a general medicine clinic (GMC) were compared. Diabetes center patients had a longer mean duration of diabetes (12 years vs. 6 years, $p < .01$), more baseline microvascular disease (65% vs. 44%, $p < .01$), and higher baseline glucose levels (hemoglobin A1c 8.6% vs. 7.9%, $p < .01$) than GMC patients. Diabetes center patients received more intensive outpatient care directed toward glucose monitoring and control. In all crude and adjusted analyses of hospitalizations and emergency room visits, no statistically significant differences for inpatient utilization or cost outcomes comparing clinic populations were found.[23]

Access to care in relation to admissions has been explicitly studied and reported. Weissman[27] found that uninsured patients had a higher risk of admission for DKA and coma than privately insured patients (adjusted O.R. = 2.18 – 2.77). Bindman[28] reported that an area's self-rated access to care report explained 46% of the variance in admissions for diabetes, though the analysis was not restricted to diabetic emergencies.

The relationship between avoidable hospitalizations for diabetes mellitus and income level was studied in a population-based cohort of persons with diabetes mellitus (N = 605 825) derived from hospital and physician service claims between April 1, 1992, and March 31, 1999 in Canada. There was a clear inverse gradient between income level and event rates. Individuals in the lowest income quintile were 44% more likely to have an event than those in

the highest quintile (16.4% vs. 11.4%, $p < .001$) and had a greater propensity toward recurrent emergency department admissions (1.9 vs. 1.6 episodes per patient; $p < .001$). The gradient was most marked in 45- to 64-year-olds (odds ratio [OR] = 1.76; 95% confidence interval [CI], 1.69-1.82) and less apparent in children (OR = 1.06; 95% CI, 0.99-1.13). The relationship between SES and events persisted after adjusting for age, sex, urban vs. rural residence, comorbidity, frequency of physician visits, continuity of care, physician specialty, and geographic region (adjusted OR = 1.09 [95% CI, 1.08-1.10] per quintile level).[29]

Salinas-Martinez et al. found that less than 2 visits to family physician during the last year (adjusted OR = 16.2; 95% CI, 1.5-174.2) increases the risk of hospitalization for diabetes related complications [30], although it is unclear whether this is associated with access to care or other factors. Veterans Administration patients were enrolled in a retrospective case control study (cases = 2,714, controls = 10, 856) studying the associations between ambulatory care services and glycemic control and hospitalization for metabolic decompensation (MD, including hypoglycemia, hyperglycemia, and DKA). Helmer et al. demonstrated that patients with poor glycemic control (HbA1c $\geq$ 9%) were more likely to experience MD if they had no clinic visits during the year, compared with patients who made at least one visit in each calendar quarter (odds ratio = 3.05; 95% CI, 1.69-5.49); however, no other significant associations were found. Increasing regularity of HbA1c testing was associated with a higher likelihood of MD in high-risk individuals.[31]

Several studies, including Billings[32] and Pappas,[33] showed that residents of low-income communities have a higher risk of "ambulatory care sensitive" admissions, including short-term diabetic complications, than residents of high-income communities. Of course, this is only indirect evidence of validity, because low income and high income communities may differ for many reasons other than access to care. In addition, these studies aggregated ambulatory-care sensitive admission rates across multiple conditions, so they do not clearly support the validity of component measures, such as admission rates for short-term diabetic complications. Two studies of ACSC indicators reported validation work for diabetes independent of measure sets. Millman et al.[34] reported that low-income zip codes had 4.1 times more diabetes hospitalizations per capita than high-income zip codes in 11 states in 1988. Billings et al.[35] found that low-income zip codes in New York City (where at least 60% of households earned less than $15,000 in 1988, based on adjusted 1980 Census data) had 6.3 times more diabetes hospitalizations per capita than high-income zip codes (where less than 17.5% of households earned less than $15,000). Household income explained 52% of the variation in short term diabetes complication hospitalization rates at the zip code level.

Fosters true quality improvement. We found no evidence regarding the gaming of this indicator. Since diabetic emergencies are potentially life-threatening, it is unlikely that physicians would fail to admit patients requiring hospitalization.

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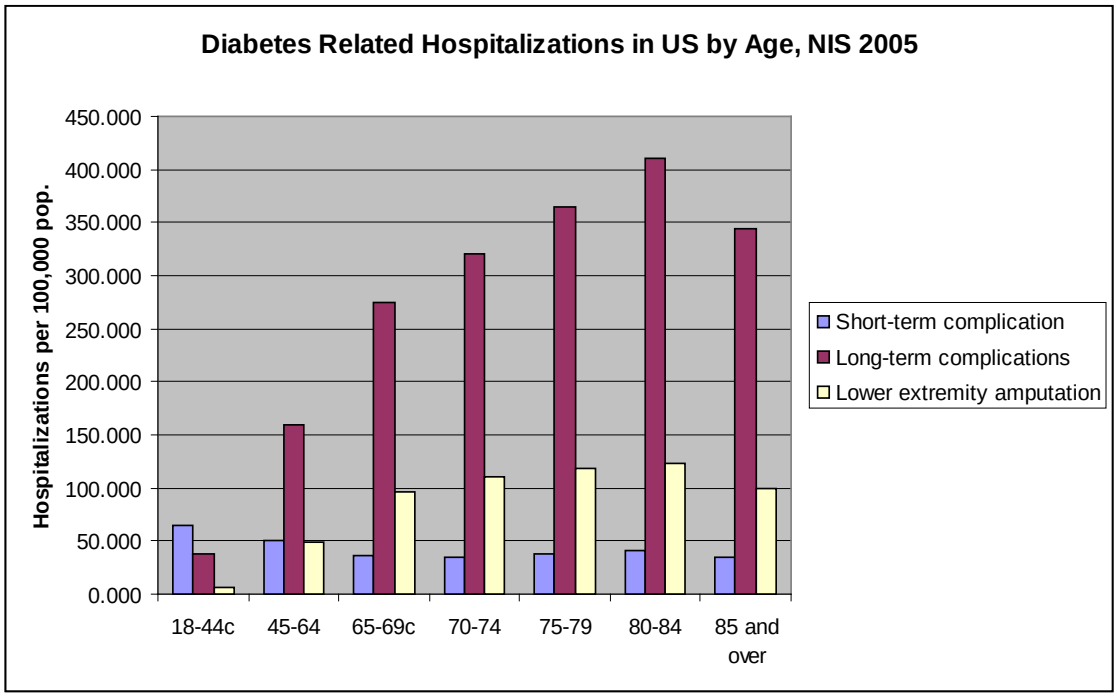
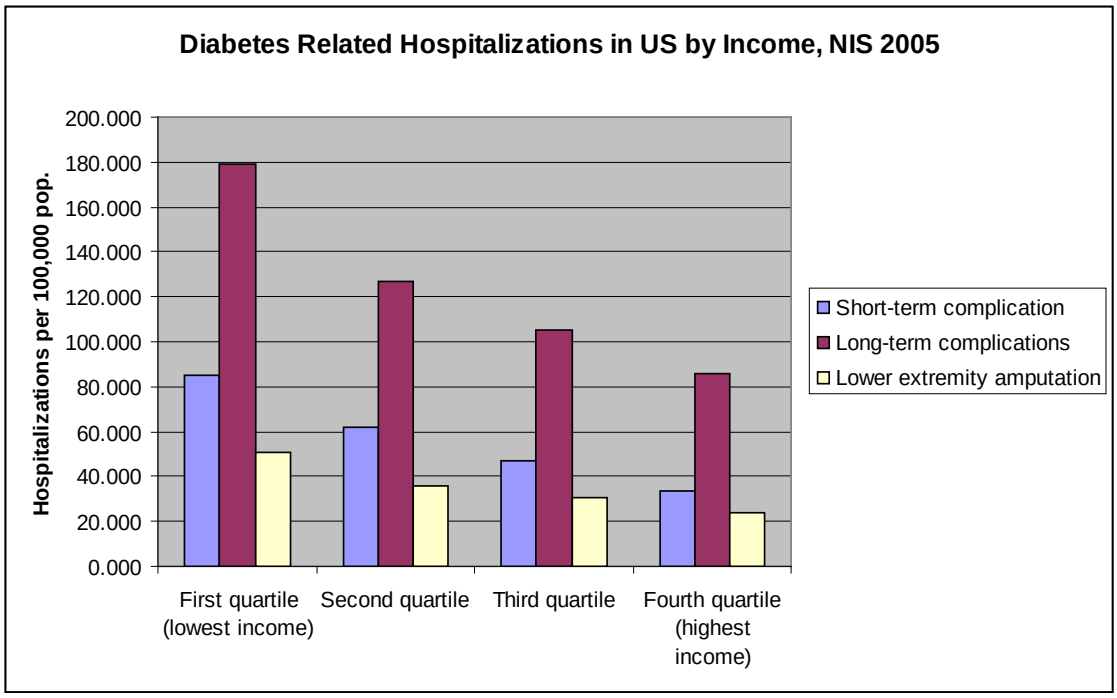
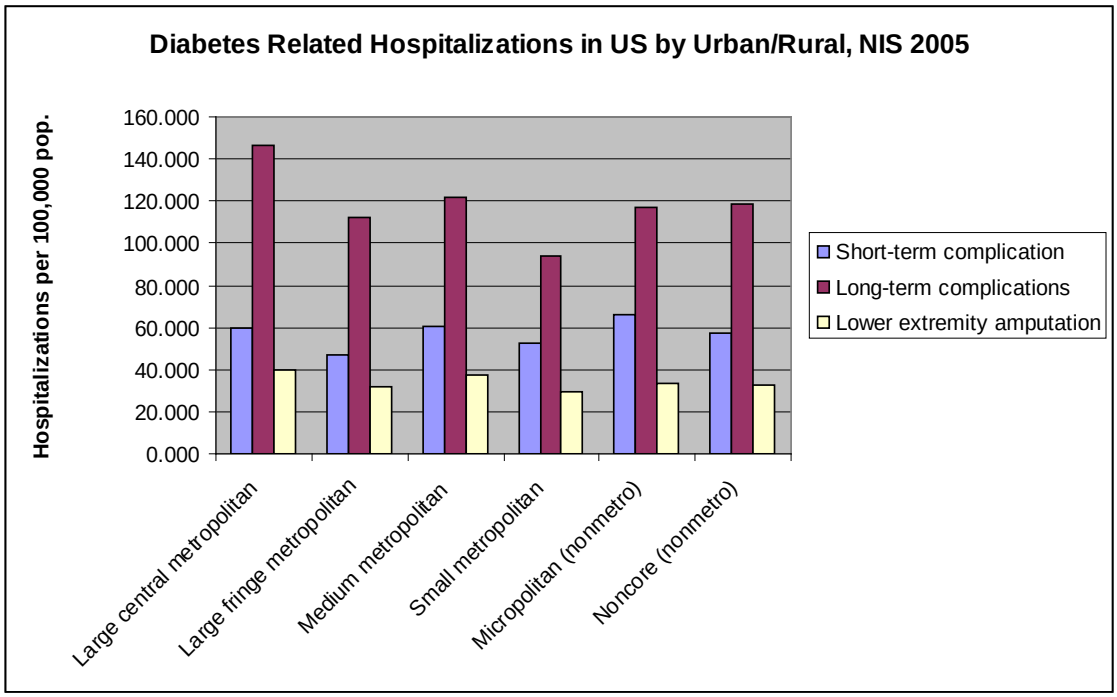
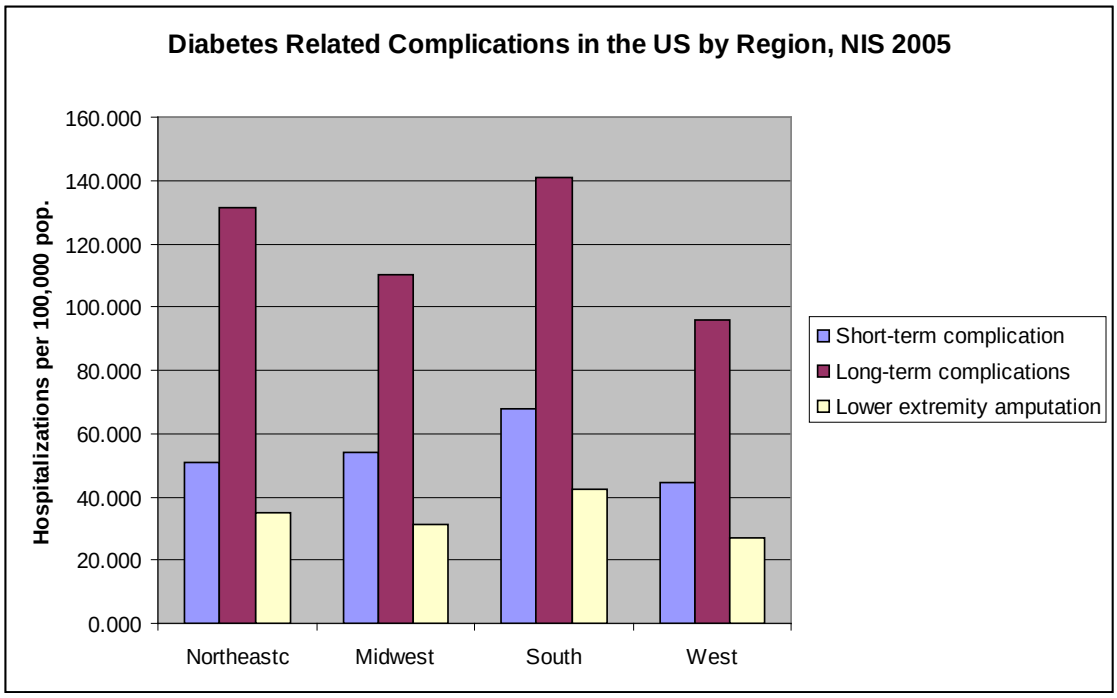
Example Admission Rate Comparisons




Diabetes Related Hospitalizations in US by Income, NIS 2005
Hospitalizations per 100,000 pop.
200.000
180.000
160.000
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0.000
First quartile (lowest income)
Second quartile
Third quartile
Fourth quartile (highest income)
Short-term complication
Long-term complications
Lower extremity amputation


Diabetes Related Hospitalizations in US by Urban/Rural, NIS 2005
Hospitalizations per 100,000 pop.
160.000
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0.000
Large central metropolitan
Large fringe metropolitan
Medium metropolitan
Small metropolitan
Micropolitan (nonmetro)
Noncore (nonmetro)
Short-term complication
Long-term complications
Lower extremity amputation



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2005, and AHRQ Quality Indicators, version 3.1.

APPENDIX B: Example indicator definition and questionnaire packet.

Indicator Definition:

DIABETES SHORT-TERM COMPLICATIONS ADMISSION RATE

Indicator definition:

Number of patients admitted for diabetes short-term complications (ketoacidosis, hyperosmolarity, and coma) per 100,000 population.

Included admissions:

Numerator:

All non-maternal/non-neonatal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for short-term complications (see below) (includes type I and type II, both stated as uncontrolled and not stated as uncontrolled).

Diabetes with ketoacidosis [250.1x]
Diabetic acidosis without mention of coma
Diabetic ketosis without mention of coma

Diabetes with hyperosmolarity [250.2x]
Hyperosmolar (nonketotic) coma

Diabetes with other coma [250.3x]
Diabetic coma (with ketoacidosis)
Diabetic hypoglycemic coma
Insulin coma (not otherwise specified)

Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of Type I or Type II diabetes prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Clinical rationale

This indicator is intended to identify hospitalizations for diabetic ketoacidosis, coma, and hyperosmolarity. The total United States hospitalization rate for short-term complications in patients with diabetes is 56.3 per 100,000 population (standard error = 1.5). With strict glucose control, these complications are avoidable.

This indicator was developed as part of the Prevention Quality Indicator measure set, and is adapted from an indicator developed by John Billings[1] and colleagues after favorable evaluation by a physician panel.

Summary of literature

- Racial differences in hospitalization rates have been noted in two US studies.
- Claims data has been shown to be highly concurrent with self-report of hospitalizations for diabetes.
- Five studies have associated lack of compliance with insulin or drug therapy with hospitalization, although it is unclear whether this lack of compliance is due to patient choice, lack of access, or lack of education.
- Six studies have shown a reduction in admission rates following interventions aimed to increase glycemic control. These interventions include intensive nurse led education, management and follow-up programs. One study demonstrated sustained effects two year after the intervention. Three did not show an effect of such programs.
- Two studies demonstrated decreased admissions in patients cared for in specialized diabetes care clinics. One did not show an effect.
- Access to care, as demonstrated by insurance status, area-level self-rated access to care and income level have been associated with higher admission rates for diabetes related conditions.
- Fewer encounters with the health care system have been associated with higher admission rates in two studies, although whether this is due to patient choice or access to care issues is not known.

See attached literature review for additional details

Additional questions to consider

Although we are not asking you to state your opinion on this form, there are some questions that we will be discussing in our conference calls on each of the indicators.

1. Usually denominators would be defined using any diagnosis code for Type I or Type II diabetes in the outpatient record. Is this definition sufficient, or would it be necessary to also introduce additional data, such as pharmacy data, to improve either the sensitivity or specificity of this indicator.

The following questionnaire assesses the usefulness of the Prevention Quality Indicators for use at three different levels: at an area level, payor level and provider organization level. Uses for the PQIs have been proposed at each of these levels. Included in the Questionnaire Directions document are several examples of potential uses at each of these levels. Keep these uses in mind as you answer each of these questions. Unless a particular level of application (area, payor or provider organization) is specified, all uses are to be considered in your response to that question.

Example Indicator Questionnaire
Indicator name: Diabetes Short-term Complications Admission Rate

1. Access barriers may relate to geographic access (i.e., distance, lack of local transportation), temporal access (i.e., after hours care), economic access (i.e. Medicaid providers), or cultural access (i.e. interpreting services). To what extent is this event likely to reflect *poor access* to outpatient care?

1	2	3	4	5	6	7	8	9
Not at all likely								Very likely

Comments:

[Question labeled "Reflects poor access" in Results by Indicator tables]

2. Poor quality care may affect such specific domains as screening, diagnosis, treatment, patient education, and follow-up. To what extent is this event likely to reflect *poor quality* outpatient care?

1	2	3	4	5	6	7	8	9
Not at all likely								Very likely

Comments:

[Question labeled "Reflects poor quality" in Results by Indicator tables]

3. How often are these diagnoses, when they are responsible for the admission, clearly charted in medical records by physicians (e.g. as opposed to using different terminology)?

1	2	3	4	5	6	7	8	9
Never charted								Always charted

Comments:

[Question labeled "Charting accuracy" in Results by Indicator tables]

4. To what extent is this indicator subject to bias (meaning that some areas/organizations will be judged as low quality because they systematically differ from other areas/organizations in some aspect, such as the prevalence of a related chronic disease, that is not due to poor quality care or poor access to care)?

1	2	3	4	5	6	7	8	9
Not at all biased								Very biased

What are the factors that contribute to the bias?

[Question labeled "Bias" in Results by Indicator tables]

5. Are there ways that areas/organizations could easily appear to better their performance on this indicator, without actually improving the accessibility or quality of care that they provide?

6. Are there adverse outcomes that could result from implementing this indicator? If so, please explain.

7. Geographic areas include the states, counties, cities, and zip codes in which patients reside. What is your overall rating of the usefulness of this indicator, for publicly reporting rates at the level of geographic areas?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

Please discuss you reasons for assigning the overall rating above.

[Question labeled "Overall usefulness – Area: public reporting" in Results by Indicator tables]

8. Payor organizations include state Medicaid agencies and their contracted managed care plans, State Children's Health Insurance Program (SCHIP) agencies and their contracted managed care plans, Medicare Advantage plans, and private managed care plans. What is your overall rating of the usefulness of this indicator, for publicly reporting rates at the level of payor organizations?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

9. Pay-for-performance programs have been implemented by some state Medicaid and SCHIP agencies to reward contracted managed care plans that facilitate higher quality or more efficient care. What is your overall rating of the usefulness of this indicator, for pay for performance at the level of payor organizations?

1 2 3 4 5 6 7 8 9
Highly discourage use Highly recommend use

Please discuss you reasons for assigning the overall ratings above (q. 8 and 9).

> [Questions labeled "Overall usefulness - Payor: public reporting" and "Overall usefulness Payor: P4P" in Results by Indicator tables for questions 8 and 9, respectively]

10. Provider organizations include capitated physician organizations and similar entities that provide comprehensive inpatient and outpatient care for a defined population. What is your overall rating of the usefulness of this indicator, for quality improvement within provider organizations?

1 2 3 4 5 6 7 8 9
Highly discourage use Highly recommend use

11. What is your overall rating of the usefulness of this indicator, for comparative public reporting amongst provider organizations?

1 2 3 4 5 6 7 8 9
Highly discourage use Highly recommend use

12. Pay-for-performance programs have been implemented by some managed care organizations to reward contracted physician organizations that provide higher quality or more efficient care. What is your overall rating of the usefulness of this indicator, for pay for performance at the level of provider organizations?

1 2 3 4 5 6 7 8 9
Highly discourage use Highly recommend use

Please discuss you reasons for assigning the overall ratings above (q. 10, 11, 12).

> [Questions labeled “Overall usefulness - PO: internal QI” “Overall usefulness - PO: public reporting” and “Overall usefulness - PO: P4P” in Results by Indicator tables for questions 10, 11 and 12, respectively]

*This section (questions 10b, 11b, and 12b) was only included for the Bacterial Pneumonia, Urinary Tract Infection, and Dehydration indicators after the first of the evaluations.

10b. What is your overall rating of the usefulness of this indicator, for quality improvement <u>for patients residing in a long term care facility</u>?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

11b. What is your overall rating of the usefulness of this indicator, for comparative public reporting <u>for patients residing in a long term care facility</u>?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

12b. What is your overall rating of the usefulness of this indicator, for pay for performance <u>for patients residing in a long term care facility</u>?

1	2	3	4	5	6	7	8	9
Highly discourage use								Highly recommend use

Please discuss you reasons for assigning the overall ratings above (q. 10b, 11b, 12b).

> [Questions labeled “Overall rating-LTCF: Internal QI” “Overall rating-LTCF: Public Reporting” and “Overall rating-LTCF: P4P” in Results by Indicator tables for questions 10b, 11b, and 12b, respectively]

13. Some indicators definitions limit the denominator to exclude patients for which admissions are likely to be unpreventable even with good quality of care, or to focus the indicator on those truly at risk for hospitalization. Are there any patients that should be excluded from this indicator? Do you have any other input on the denominator for this indicator?

14. Would you suggest any changes to the definition of this indicator? Please specify changes and give rationale supporting proposed changes.

15. Is there anything else that you would like us to know about this indicator?

Example Risk Adjustment Questionnaire

For this task, we ask that you rate importance of each of the following data elements, as follows:

1: Not at all important
2: Somewhat important
3: Very important
4: Essential

1. Comorbid diagnoses codes within past year
2. Prior hospital admissions within past year
3. Prior ED visits within past year
4. Pharmaceutical use within past year
5. Comorbid diagnoses codes at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*
6. Prior hospital admissions at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*
7. Prior ED visits at intake for patients joining plan or medical group in the past 3 years, or within the 12 month period 3 years prior for patients enrolled more than 3 years in plan/medical group*
8. Socioeconomic status (measured by median income in patient zip code)
9. Race

APPENDIX C: List of Clinical Expert Panelists

The following panelists served in the process of gathering and providing information in this research project through the evaluation of indicators. The statements made in this report should in no way be construed as any one of the following panelist's particular point of view. Some panelists requested that their affiliation with this report remain anonymous, and this list is therefore a partial representation of the individuals that comprised the panels in their entirety.

We wish to express our gratitude to all of the panelists for their contributions in both time and thorough evaluation of the AHRQ Prevention Quality Indicators.

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APPENDIX D: Indicator definitions evaluated by panelists in the final evaluation cycle.

This appendix lists the PQI definitions that were presented to panelists for the final round of evaluation. The definitions below contain the original wording of the definitions; however, changes recommended during the process of the panel prior to the final round are highlighted through underlining (for additions recommended to the definition) and ~~strikethrough~~ (for eliminations recommended from the definition). Empirical analyses were conducted for recommendations that would require further investigation in some circumstances. Empirical analyses are provided along with the definition for indicators in which they were conducted.

Diabetes Short-term Complications Admission Rate (PQI 1)

Indicator definition:

Number of patients admitted for diabetes short-term complications (ketoacidosis, hyperosmolarity, and coma) per 100,000 population.

Included admissions:

Numerator:

All non-maternal/non-neonatal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for short-term complications (see below) (includes type I and type II, both stated as uncontrolled and not stated as uncontrolled).

Diabetes with ketoacidosis [250.1x]

Diabetic acidosis without mention of coma
Diabetic ketosis without mention of coma

Diabetes with hyperosmolarity [250.2x]

Hyperosmolar (nonketotic) coma

Diabetes with other coma [250.3x]

Diabetic coma (with ketoacidosis)
Diabetic hypoglycemic coma
Insulin coma (not otherwise specified)

Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)
Data Alternative (When additional data is available): Include encounters from Emergency Department and/or short stay units.

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of Type I or Type II diabetes (excluding gestational diabetes) recorded on 2 separate encounters in the 36 months prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator to patients with diagnosis code for diabetes in at least 2 separate encounters over past 36 months.
2. Clarify that qualifying denominator codes do not include gestational diabetes.
3. When available, stays for short-term diabetes complications in the ED or short stay units that do not result in admission should be included in the numerator.

Summary of Rationale for Changes

- To reduce false positives for patients identified as having diabetes, panelists suggested requiring multiple diagnoses in separate encounters over a specified timeframe such as 18-36 months. Panelists felt that patients without diabetes may receive diabetes-related codes mistakenly, and these may be due to a number of blood glucose elevations through related procedures or trauma. In addition, patients with diabetes may receive diabetes codes not specific to their actual condition. For example, a patient with Type 1 diabetes may arbitrarily receive a Type 2 diabetes code after they reach older age (40 years or older was offered as a timeframe that this may occur).
- The panel supported the notion that data on presentations for the conditions in this indicator to the Emergency Department, observation unit, or short-stay unit would be valuable to the interpretation of this indicator when the data is available. The panel felt that variation in inpatient admissions captured by this metric may be influenced by the presence of observation units. Further, some emergency departments may practice a different threshold of admission knowing that they can ameliorate these conditions quickly if the patient is admitted. The panel was unsure whether these practices should be considered a difference in "quality of care," but including the data of these outpatient encounters would give a more complete view for the Diabetes Short-term complications indicator.

Perforated Appendix Admission Rate (PQI 2)

There were no changes from the original definition of the Perforated Appendix indicator during the panel process.

Indicator definition:

Number of patients admitted for perforated appendix per 100 admissions for appendicitis within Metro Area or county.

Numerator:

Discharges with ICD-9-CM diagnosis code for perforations or abscesses of appendix (see below) in any field among cases meeting the inclusion rules for the denominator.

Acute appendicitis [540]

With generalized peritonitis [540.0]:

Appendicitis (acute) with: perforation, peritonitis (generalized), rupture:
Fulminating, Gangrenous, Obstructive
Cecitis (acute) with: perforation, peritonitis (generalized), rupture
Rupture of appendix

With peritoneal abscess [540.1]

Abscess of appendix with generalized peritonitis

Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

All non-maternal discharges of age 18 years and older in Metro Area or county with diagnosis code for appendicitis in any field (population at risk):

Acute appendicitis codes 540.0 and 540.1 (see above)

Without mention of peritonitis [540.9]:

Acute:
Appendicitis without mention of perforation, peritonitis, or rupture:
Fulminating, Gangrenous, Inflamed, Obstructive
Cecitis without mention of perforation, peritonitis, or rupture

Appendicitis not otherwise specified [541]

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Diabetes Long-term Complications Admission Rate (PQI 3)

Indicator definition:

Number of patients admitted for diabetes long-term complications (see definition and exclusions below) per 100,000 population.

Included admissions:

Numerator:

Discharges age 18 years and older with ICD-9-CM principal diagnosis code for long-term complications (see below) (includes type I and type II, stated as uncontrolled and not stated as uncontrolled).

Diabetes with renal manifestations (250.4x)
Includes: chronic kidney disease, diabetic nephropathy NOS, diabetic nephrosis, intercapillary glomerulosclerosis, and Kimmelstiel-Wilson syndrome

Diabetes with ophthalmic manifestations (250.5x)
Includes: blindness, cataract, glaucoma, macular edema, retinal edema, and retinopathy

Diabetes with neurological manifestations (250.6x)
Includes: amyotrophy, gastroparalysis, gastroparesis, mononeuropathy, neruogenic arthropathy, peripheral autonomic neuropathy, and polyneuopathy

Diabetes with peripheral circulatory disorders (250.7x)
Includes: gangrene and peripheral angiopathy

~~**Diabetes with other specified manifestations** (250.8x)~~
~~Includes: diabetic hypoglycemia, hypoglycemic shock, associated ulceration, and diabetic bone changes~~

~~**Diabetes with unspecified complication** (250.9x)~~

Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of Type I or Type II diabetes (excluding gestational diabetes) recorded on 2 separate encounters in the 36 months prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Remove codes 250.8x and 250.9x from the numerator (see strike through text above and empirical analyses below).

2. Limit denominator to patients with diagnosis code for diabetes in at least 2 separate encounters over past 36 months.
3. Clarify that qualifying denominator codes do not include gestational diabetes.

Results from Empirical Analyses
The following table shows the breakdown in numerator cases for each code included in the numerator. Panelists reached consensus that 250.8x and 250.9x should not be included in this indicator because it is uncertain what would be included in these codes, and some complications may better fit into the short-term complications indicator. Removing those two codes would eliminate about half of numerator cases.

Code	Numerator	Rate per 100,000	Percent share of numerator
250.4x: Renal manifestations	53,570	24	9.6%
250.5x: Ophthalmic manifestations	3,952	2	0.7%
250.6x: Neurological manifestations	132,646	59	23.7%
250.7x: Peripheral circulatory man.	96,341	43	17.2%
250.8x: Other specified	259,421	116	46.4%
250.9x: Unspecified	12,942	6	2.3%
TOTAL	558,871	249	100%

From the 2004-2005 HCUP State Inpatient Database

Additional Literature
Ginde et al. examined cases of hypoglycemia in the emergency department using ICD-9-CM diagnosis codes in three large academic centers. They found that 62% of cases coded as 250.8 represented hypoglycemia. The majority of the remaining cases were cellulitis and osteomyelitis. Two percent of cellulitis, infection or osteomyelitis cases also had hypoglycemia. (See: Ginde, AA et al. "Validation of ICD-9-CM coding algorithm for improved identification of hypoglycemia visits." BMC Endocrine Disorders. 2008, 8:4)
Summary of Rationale for Changes

- To reduce false positives for patients identified as having diabetes, panelists suggested requiring multiple diagnoses in separate encounters over a specified timeframe such as 18-36 months. Panelists felt that patients without diabetes may receive diabetes-related codes mistakenly, and these may be due to a number of blood glucose elevations through related procedures or trauma. In addition, patients with diabetes may receive diabetes codes not specific to their actual condition. For example, a patient with Type 1 diabetes may arbitrarily receive a Type 2 diabetes code after they reach older age (40 years or older was offered as a timeframe that this may occur).
- Panelists discussed whether to include the ICD-9-CM codes 250.8x (Diabetes with Other Specified Manifestations) and 250.9x (Diabetes with Unspecified Complication). Since the code 250.8x includes hypoglycemia as well as a variety of both acute and chronic complications, we asked panelists to consider the appropriateness of including this group of complications in the Diabetes Long-term Complications indicator. Although not unanimous, many panelists voted that neither ICD-9-CM code (250.8x nor 250.9x) should be included in the numerator definition. The argument against their continued placement in the numerator

included a high level of variability in the utilization and particular use of these codes (hypoglycemia vs. diabetic bone changes) and possibly variability due to changes in billing efforts at the system level. A couple of panelists felt that users of this indicator may still benefit from including these codes as they may be heavily used, and therefore, may still have utility in identifying potentially preventable admissions.

Chronic Obstructive Pulmonary Disease (COPD) Admission Rate (PQI 5)

Indicator definition: Number of patients admitted for chronic obstructive pulmonary disease or asthma, age 40+ years.
Included Admissions:

Numerator:

All non-maternal discharges of age 40 years and older with ICD-9-CM principal diagnosis code for COPD or Asthma.

Bronchitis, not specified as acute or chronic* [490]
Excludes: Allergy NOS, Asthma NOS, & due to vapors or fumes
Acute bronchitis* [466.0]
Chronic bronchitis [491]
Simple chronic bronchitis [491.0]
Mucopurulent chronic bronchitis [491.1]
Obstructive chronic bronchitis with and without acute exacerbation [491.2x]
Other chronic bronchitis [491.8]
Unspecified chronic bronchitis [491.9]
Excludes: Chronic obstructive asthma
Emphysema [492]
Emphysematous bleb [492.0]
Other emphysema [492.8]
Bronchiectasis [494]
With and without acute exacerbation [494.x]
Chronic airway obstruction, not elsewhere classified [496]

OR

Extrinsic asthma [493.0x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Intrinsic asthma [493.1x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Chronic obstructive asthma [493.2x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Other forms of asthma [493.8x]
Exercise induced bronchospasm
Cough variant asthma
Asthma, unspecified [493.9x]
Unspecified, With status asthmaticus, With (acute) exacerbation

Code qualifies only when accompanied by secondary diagnosis code of chronic bronchitis, emphysema or bronchiectasis. Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

Area applications: Population in Metro Area or county, age 40 years and older.
Payor/provider applications: Patients with diagnosis of COPD or asthma prior to hospitalization, age 40 years and older.
Optional stratification: Stratify patients with 3 or more admissions within one year.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator and numerator population to patients older than 40 years of age.
2. Include diagnoses codes for asthma or COPD in numerator statement.

3. Limit denominator to patients with an asthma or COPD diagnosis in at least 2 encounters in the past 36 months.
4. Added optional stratification: Stratify patients with 3 or more admissions in a 12-month period.

Results from Empirical Analyses

The following analyses demonstrate the breakdown of COPD and Asthma diagnoses in patients age 40 and above and those under age 40. Panelists noted that in older patients, the distinction between asthma and COPD is less clear and suggested that combining these diagnoses may be more accurate. In patients younger than age 40, COPD is rare.

	Age restriction	Numerator Cases	Rate per 100,000 population	Percent share
COPD	All cases	997,185	445	
	40 years old or older	985,271	745	98.81
	Less than 40 years old	11,915	13	1.19
Asthma	All cases	551,083	246	
	40 years old or older	437,616	331	79.41
	Less than 40 years old	113,467	123	20.59

From the 2004-2005 HCUP State Inpatient Database

Summary of Rationale for Changes

- Panelists advocated for restricting the indicator to patients 40 years of age and older and combining with asthma admissions in this age group. Empirical analysis confirmed that COPD diagnoses in cases under 40 years of age are rare. Panelists felt that combining these groups would eliminate the diagnostic uncertainly between asthma and COPD in older patients, and thus provide a cleaner measure.
- For stratifying patients with advanced disease or frequent exacerbations due to individual circumstances, panelists suggested an optional stratification for 3 or more admissions within a one year period.

Hypertension Admission Rate (PQI 7)

Indicator definition:

Number of patients admitted for hypertension.

Included Admissions:

Numerator:

All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for hypertension (see below).

Essential hypertension
- Malignant [401.0]
- Hypertension not otherwise specified [401.9]

Hypertensive heart disease (without heart failure)
- Malignant [402.00]
- Benign [402.10]
- Not otherwise specified [402.90]

Hypertensive chronic kidney disease (chronic kidney disease stages I-IV or unspecified)
- Malignant [403.00]
- Benign [403.10]
- Not otherwise specified [403.90]

Hypertensive heart and chronic kidney disease (without heart failure, chronic kidney disease stages I-IV or unspecified)
- Malignant [404.00]
- Benign [404.10]
- Not otherwise specified [404.90]

Exclude cases with cardiac procedure codes in any field, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of hypertension in at least two encounters in the past 36 months prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator to patients with a hypertension diagnosis in at least 2 encounters in the past 36 months.

Summary of Rationale for Changes

- Panelists noted that while for payor and provider applications patients with previously diagnosed hypertension is the most fertile group for intervention, screening remains important and may impact admission rates. For public health applications in particular panelists felt that including all patients in the denominator, regardless of a prior diagnosis of hypertension, would be most appropriate.
- Panelists noted that a single admission for hypertension may not be an accurate measure of access to quality outpatient care in some applications. These panelists advocated for multiple admissions within a 36 months period prior to primary hospitalization for hypertension in payor and provider applications.

Congestive Heart Failure (CHF) Admission Rate (PQI 8)

Indicator definition:

Number of patients admitted for congestive heart failure per 100,000 population.

Included Admissions:

Numerator:

All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for CHF (see below).

Rheumatic heart failure (congestive) [398.91]

Hypertensive heart disease (with heart failure)
Malignant [402.01], Benign [402.11], Not otherwise specified [402.91]

Hypertensive heart and chronic kidney disease
With heart failure and chronic kidney disease stages I-IV or unspecified
Malignant [404.01], Benign [404.11], Not otherwise specified [404.91]

With heart failure and chronic kidney disease stage V or end stage renal disease
Malignant [404.03], Benign [404.13], Not otherwise specified [404.93]

Heart Failure
Congestive heart failure [428.0]
Left heart failure [428.1]
Systolic heart failure [428.2x]
Diastolic heart failure [428.3x]
Combined systolic and diastolic heart failure [428.4x]
Heart failure not otherwise specified [428.9]

Exclude cases with cardiac procedure codes in any field, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)

Denominator:

Area applications: Population in Metro Area or county, age 18 years or older.
Payor/provider applications: Patients with diagnosis of heart failure in at least two encounters in the past 36 months prior to hospitalization, age 18 years or older.
Optional stratification: Stratify patients with 3 or more admissions within one year.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator to patients with a heart failure diagnosis in at least 2 encounters in the past 36 months.
2. Added optional stratification: Stratify patients with 3 or more admissions in a 12-month period.

Results from Empirical Analyses

The following analyses show the breakdown of numerator codes. Panelists expressed concern that hypertensive heart disease patients with chronic kidney disease would be admitted for kidney disease. This analysis shows that only 2.3% of numerator patients represent those with end stage kidney disease. In clarification, patients admitted for either CHF exacerbation or kidney complications would receive these codes. We cannot distinguish those admitted primarily for kidney complications in this group, but the percentage of the numerator attributable to these patients is small.

Code	Heart Failure Type	Share of numerator
398.91	Rheumatic heart failure	2.72%
402.01, 11, 91	Hypertensive heart disease	4.71%
404.01, 404.11, 404.91	Hypertensive heart disease with chronic kidney disease stages I-IV	0.30%
404.03, 404.13, 404.93	Hypertensive heart disease with chronic kidney disease stage V	2.30%
428.0	Congestive heart failure	82.49%
428.1	Left heart failure	0.18%
428.2x	Systolic heart failure	2.38%
428.3x	Diastolic heart failure	4.31%
428.4x	Combined systolic and diastolic heart failure	0.57%
428.9	Heart failure not otherwise specified	0.05%

From the 2004-2005 HCUP State Inpatient Database

Summary of Rationale for Changes

- Panelists noted that a single admission for CHF may not be an accurate measure of access to quality outpatient care in some applications. These panelists advocated for multiple admissions within a 36 months period prior to primary hospitalization for CHF in payor and provider applications.
- For stratifying patients with advanced disease or frequent exacerbations due to individual circumstances, panelists suggested an optional stratification for 3 or more admissions within a one year period.

Dehydration Admission Rate (PQI 10)

Indicator definition: Number of patients admitted for dehydration.

Included Admissions:

Numerator: All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for hypovolemia (see below).

Volume depletion [276.5]
Exclude: hypovolemic shock – postoperative & traumatic
Volume depletion, unspecified [276.50]
Dehydration [276.51]
Hypovolemia [276.52]

OR

Patients with a principal diagnosis of gastroenteritis when accompanied by a secondary diagnosis of dehydration designated as present on admission.

OR

Patients with a principal diagnosis of acute renal failure, without any other diagnosis of chronic kidney disease, when accompanied by a secondary diagnosis of dehydration designated as present on admission.

Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)
Data alternative (When additional data is available): Include encounters for dehydration in an emergency department and/or short stay unit.

Denominator:
Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: All patients, age 18 years and older.
Alternative application: All patients residing in a long term care facility, age 18 and older.

Risk adjustment:
Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator
1. When available, stays for short-term diabetes complications in the ED or short stay units that do not result in admission should be included in the numerator.
2. Include principal diagnosis of gastroenteritis when accompanied by a secondary diagnosis of dehydration designated as present on admission. Include principal diagnosis of acute renal

failure, without any other diagnosis of chronic kidney disease, when accompanied by a secondary diagnosis of dehydration designated as present on admission.

3. Clarify that indicator does not currently include numerator cases admitted from a long-term care facility when specified in administrative data.
4. Added alternative application, where the denominator would only include patients residing in a long-term care facility.

Results from Empirical Analyses

The following analyses demonstrate the impact of including cases with a secondary diagnosis when accompanied by specified principal diagnoses. Panelists identified these diagnoses as alternative diagnoses for dehydration cases. The analyses show the most cases are captured by gastroenteritis and acute renal failure. Note that these numbers do not take into account present on admission designation.

Codes	Numerator cases	Rates per 100,000
Principal diagnosis of dehydration	550,396	245
Principal diagnosis: hypo/hypernatermia, secondary diagnosis: dehydration	18,196	8
Principal diagnosis: azotemia Secondary diagnosis: dehydration	345	0
Principal diagnosis: gastroenteritis, Secondary diagnosis: dehydration	132,098	59
Principal diagnosis: Acute renal failure, Secondary diagnosis: dehydration without any code for chronic renal failure*	218,228	100

From the 2004-2005 HCUP State Inpatient Database

*Patients with a code for chronic kidney disease comprise about 10% of those patients with a principal diagnosis of acute renal failure, and a secondary diagnosis of dehydration. These patients are excluded since they may be subject to dehydration secondary to drug therapy for chronic kidney disease.

Summary of Rationale for Changes

- Panelists commented that cases of preventable admissions for dehydration may be measured with dehydration in the secondary diagnosis position. The panel discussed including cases with a principal diagnosis of gastroenteritis, hyper- or hyponatremia, azotemia, acute renal failure, respiratory infection, or urinary tract infection when accompanied by a secondary diagnosis of dehydration. Ultimately, the panel supported including two of these co-morbid conditions in the numerator: 1) principal gastroenteritis admissions with dehydration that is present on admission, and 2) principal acute renal failure admission with dehydration that is present on admission. Panelists emphasized that included cases of acute renal failure should not be those with a history of chronic renal failure.
- The indicator does not currently include admission from a long-term care facility; however, the panels showed strong support for this application of the Dehydration indicator as these facilities may be in a position to effectively intervene in issues of dehydration.
- Panelists commented that emergency department care for dehydration may be an important consideration in the interpretation of this indicator if the data is available. Due to increased risk for dehydration in short-term complications of diabetes, these patients may be given consideration in the evaluation at the emergency care level.

Bacterial Pneumonia Admission Rate (PQI 11)

Indicator definition:
Number of patients admitted for bacterial pneumonia.

Included Admissions:

Numerator:
All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for bacterial pneumonia (see below).

Pneumococcal pneumonia [481]

Pneumonia due to Hemophilus influenzae (H. influenzae) [482.2]

Pneumonia due to Streptococcus [482.3x]
Streptococcus, unspecified; Group A; Group B; Other Streptococcus

Bacterial pneumonia not otherwise specified [482.9]

Pneumonia due to other unspecified organism [483.x]
Mycoplasma pneumonia, Chlamydia, Other specified organism

Bronchopneumonia, organism not otherwise specified [485]

Pneumonia, organism not otherwise specified [486]

Aspiration Pneumonia [507.0]

Exclude cases with diagnosis code for sickle cell anemia or HB-S disease, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates)
Does not include patients admitted from long term care facilities.

Denominator:
Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: All patients, age 18 years and older.
Alternative application: All patients residing in a long term care facility, age 18 and older.

Risk adjustment:
Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Add code 507.0, "Aspiration pneumonia" to numerator at suggestion of panel. This represents another important pneumonia admission.
2. Clarify that indicator does not currently include numerator cases admitted from a long-term care facility when specified in administrative data.
3. Added alternative application, where the denominator would only include patients residing in a long-term care facility.

Results from Empirical Analyses

The following table demonstrates the impact of adding the aspiration pneumonia code to the numerator.

		Numerator Cases	Rate per 100,000
Pneumonia: As previously defined		1,938,391	865
Pneumonia including aspiration pneumonia	507.0	2,259,364	1,008

From the 2004-2005 HCUP State Inpatient Database

Summary of Rationale for Changes

- Panelists suggested that the inclusion of ICD-9-CM code for aspiration pneumonia may be warranted as up to 15% of pneumonia cases may be coded as such.
- The indicator does not currently include admissions from a long-term care facility. Panelists advocated this denominator population as these facilities may be in a position to ensure that vaccinations are current and to control more care-and patient-level factors associated with pneumonia admissions.

Urinary Tract Infection Admission Rate (UTI 12)

Indicator definition: Number of patients admitted for urinary tract infection per 100,000 population.
Included Admissions:

(Definition table continued on next page)

Numerator:

All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for urinary tract infection (see below).

Acute pyelonephritis
- Without lesion of renal medullary necrosis [590.10]
- With lesion of renal medullary necrosis [590.11]

Renal and perinephric abscess [590.2]

Pyeloureteritis cystica [590.3]

Other pyelonephritis or pyonephrosis, not specified as acute or chronic
- Pyelitis or pyelonephritis not otherwise specified [590.80]
- Pyelitis or pyelonephritis in diseases classified elsewhere [590.81]

Infection of kidney, not otherwise specified [590.9]

Cystitis
- Acute cystitis [595.0] - *Exclude: trigonitis*
- Cystitis, not otherwise specified [595.9]

Urinary tract infection, not otherwise specified [599.0]

OR

Patients with a principal diagnosis code of sepsis, with a secondary diagnosis of UTI designated as present on admission.

Exclude cases with diagnosis code of kidney/urinary tract disorder, with diagnosis code of immunocompromised state, and with immunocompromised state procedure code. Exclude patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates).
Does not include patients admitted from long term care facilities.

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: All patients, age 18 years and older. Exclude patients with a diagnosis code of spinal cord injury, brain injury, and prostate hyperplasia with urinary obstruction.
Alternative application: All patients residing in a long term care facility, age 18 and older. Exclude patients with a diagnosis code of spinal cord injury, brain injury, and prostate hyperplasia with urinary obstruction.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Include principal diagnosis of sepsis with a secondary diagnosis of UTI designated as present on admission in the numerator statement.
2. Exclude patients with spinal cord, brain injuries or prostate hyperplasia with urinary obstruction from the denominator.
3. Clarify that indicator does not currently include numerator cases admitted from a long-term care facility when specified in administrative data.
4. Added alternative application, where the denominator would only include patients residing in a long-term care facility.

Results from empirical analyses

The following table demonstrates the impact of adding cases with a principal diagnosis of sepsis, with a secondary diagnosis of UTI. Note that this table does not take into account whether or not the UTI was present on admission. Because the term urosepsis is coded as sepsis, panelists advocated for adding this combination of codes to the numerator of this indicator.

	Numerator cases	Rate per 100,000 population
Principal diagnosis: UTI	799,227	356
Principal diagnosis: sepsis Secondary diagnosis: UTI	331,617	148

From the 2004-2005 HCUP State Inpatient Database

Summary of Rationale for Changes

- The panels favored inclusion of sepsis as a primary diagnosis with UTI as a secondary diagnosis in the numerator definition, but it will be important to complete further validation following this change. Panelists felt that admission purely related to primary diagnosis for UTI may be rare. These panelists advocated this change as they felt that admission for sepsis secondary to UTI may represent cases of decreased access or lower quality of care.
- The new exclusions recommended to the payor, provider, and long-term care denominator levels were added under the rationale that these patients may experience higher levels of non-preventable cases of UTI.

Angina without Procedure Admission Rate (PQI 13)

Indicator definition:

Number of patients admitted for angina (without procedures).

Included Admissions:

Numerator:

All non-maternal discharges of age 18 years and older with ICD-9-CM principal diagnosis code for angina (see below).

Intermediate coronary syndrome [411.1]
- Impending infarction
- Preinfarction angina
- Preinfarction syndrome
- Unstable angina

Acute coronary occlusion without or not resulting in myocardial infarction [411.81]
- Embolism, Obstruction, Occlusion, Thrombosis

Other acute and subacute forms of ischemic heart disease [411.89]
- Coronary insufficiency (acute)
- Subendocardial ischemia

Angina pectoris [413.x]
- Angina decubitus
- Prinzmetal angina
- Angina pectoris, not otherwise specified, not elsewhere classified

Exclude cases with code for cardiac procedure in any field, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates).

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of Coronary Artery Disease (CAD) or angina in at least two encounters in the past 36 months prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator to patients with a CAD or angina diagnosis in at least 2 encounters in the past 36 months.

Summary of Rationale for Changes

- Panelists noted that a single admission for Angina may not be an accurate measure of access to quality outpatient care in some applications. These panelists advocated for multiple admissions within a 36 months period prior to primary hospitalization for Angina in payor and provider applications.

Adult Asthma Admission Rate (PQI 15)

Indicator definition:

Number of patients admitted for adult asthma.

Included Admissions:

Numerator:

All non-maternal discharges of age 18 – 39 years and older with ICD-9-CM principal diagnosis code for asthma (see below).

Extrinsic asthma [493.0x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Intrinsic asthma [493.1x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Chronic obstructive asthma [493.2x]
Unspecified, With status asthmaticus, With (acute) exacerbation
Other forms of asthma [493.8x]
Exercise induced bronchospasm
Cough variant asthma
Asthma, unspecified [493.9x]
Unspecified, With status asthmaticus, With (acute) exacerbation

Exclude cases with any diagnosis code of cystic fibrosis and anomalies of the respiratory system, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates).

Denominator:

Area applications: Population in Metro Area or county, age 18 -39 years.
Payor/provider applications: Patients with diagnosis of asthma in at least two encounters in the past 36 months prior to hospitalization, age 18 -39 years.
Optional stratification: Stratify patients with 3 or more admissions within one year.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator and numerator population to patients 18-39 years of age.
2. Limit denominator to patients with an asthma diagnosis in at least 2 encounters in the past 36 months.
3. Added optional stratification: Stratify patients with 3 or more admissions in a 12-month period.

Results from Empirical Analyses

The following analyses demonstrate the breakdown of COPD and Asthma diagnoses in patients age 40 and above and those under age 40. Panelists noted that in older patients, the distinction between asthma and COPD is less clear and suggested that combining these diagnoses may be more accurate. In patients younger than age 40, COPD is rare.

	Age restriction	Numerator Cases	Rate per 100,000 population	Percent share
COPD	All cases	997,185	445	
	40 years old or older	985,271	745	98.81
	Less than 40 years old	11,915	13	1.19
Asthma	All cases	551,083	246	
	40 years old or older	437,616	331	79.41
	Less than 40 years old	113,467	123	20.59

From the 2004-2005 HCUP State Inpatient Database

Summary of Rationale for Changes

- Panelists endorsed restricting the indicator to patients less than 40 years of age. Panelists felt that combining the COPD and Asthma numerator for patients 40 years and older would eliminate the diagnostic uncertainly between asthma and COPD in older patients, and thus provide a cleaner measure. COPD diagnoses in cases under 40 years of age are rare, and therefore, cases of patients less than 40 years are more likely to be true cases of asthma.
- Panelists noted that a single admission for Asthma may not be an accurate measure of access to quality outpatient care in some applications. These panelists advocated for multiple admissions within a 36 months period prior to primary hospitalization for Asthma in payor and provider applications.
- For stratifying patients with advanced disease or frequent exacerbations due to individual circumstances, panelists suggested an optional stratification for 3 or more admissions within a one year period.

Rate of Lower-extremity Amputation among Patients with Diabetes (PQI 16)

Indicator definition:

Number of patients admitted for lower-extremity amputation in patients with diabetes per 100,000 population.

Included Admissions:

Numerator:

All non-maternal discharges of age 18 years and older with ICD-9-CM procedure code for lower-extremity amputation in any field and diagnosis code of diabetes in any field (see below).

ICD-9-CM procedure codes for lower-extremity amputation:

Amputation of lower limb [84.1x]

Other amputation below knee
Amputation through foot
Disarticulation of knee
Disarticulation of hip
Amputation of toe
Disarticulation of ankle
Amputation above knee
Abdominopelvic amputation
Lower limb amputation, not otherwise specified
Amputation of ankle through malleoli of tibia and fibula
exclude revision of amputation stump

ICD-9-CM diagnosis codes for diabetes:

Diabetes Mellitus [250.xx]

Exclude cases with trauma diagnosis code in any field, patients transferring from another institution, MDC 14 (pregnancy, childbirth, and puerperium), or MDC 15 (newborns and neonates).

Denominator:

Area applications: Population in Metro Area or county, age 18 years and older.
Payor/provider applications: Patients with diagnosis of Type I or Type II diabetes prior to hospitalization, recorded on 2 separate encounters in the 36 months prior to hospitalization, age 18 years and older.

Risk adjustment:

Age and sex risk adjustment is currently incorporated for this indicator. A risk adjustment system for provider organization or health plan applications has not been developed. However, potential risk adjustment could take into account prior hospitalizations, prior ED utilization, diagnoses codes from outpatient records, and potentially pharmacy data. Note that clinical results from laboratory tests are not likely to be available. Please see the risk adjustment evaluation form.

Changes to Indicator

1. Limit denominator to patients with diagnosis code for diabetes in at least 2 separate encounters over past 36 months.

Results from Empirical Analyses

The following table shows the breakdown in numerator cases for each code included in the numerator. One panelist expressed concern that some procedures may be performed increasingly on an outpatient basis. Data reported from 1989-1992 show a similar distribution of levels for inpatient procedures as we calculated in the 2004-2005 Nationwide Inpatient Sample, which suggests that over this period of time no single procedure type has moved to the outpatient setting.

Codes	Percent share of numerator	Percent share in Reiber, et al.
84.11: Toe	48.4%	40.3%
84.12, 3, 4: Foot/ankle	15.7%	14.5%
84.15: Below knee	26.1%	25.1%
84.16: Knee disarticulation	0.4%	1.3%
84.17: Above knee	15.2%	16.0%
84.18,9: Hip/pelvis	0.1%	0.2%

Additional Literature

The breakdown of amputation levels in hospital discharge records (1989-1992 National Hospital Discharge Surveys) was reported in Reiber GE, Boyko EJ, Smith DG. Lower extremity foot ulcers and amputations in diabetes. In: Harris MI, Cowie CC, Stern MP, Boydo EJ, Reiber GE, Bennett PH, eds. Diabetes in America, 2nd ed. Washington, DC: U.S. Government Printing Office, 1995; DHHS publication no. (NIH)95-1468. The breakdown is reported in the above table.

Summary of Rationale for Changes

- To reduce false positives for patients identified as having diabetes, panelists suggested requiring multiple diagnoses in separate encounters over a specified timeframe such as 18-36 months. Panelists felt that patients without diabetes may receive diabetes-related codes mistakenly, and these may be due to a number of blood glucose elevations through related procedures or trauma. In addition, patients with diabetes may receive diabetes codes not specific to their actual condition. For example, a patient with Type 1 diabetes may arbitrarily receive a Type 2 diabetes code after they reach older age (40 years or older was offered as a timeframe that this may occur).